

[back](#)

[HOME](#)

Lancaster University

Department of Independent Studies

A Pattern Language of Sustainability Ecological design and Permaculture

By [Joanne Tippett](#)

April, 1994

Director of Study: Alan Holland

This dissertation is submitted in part fulfilment for
the degree of BA (Hons.) in Independent Studies

Acknowledgements

I would like to thank my Director of Study, Alan Holland for his assistance in writing this thesis and in helping me to

clarify many of my ideas about permaculture design. I would also like to thank Bill Fuge, in Independent Studies, for allowing me the freedom to change directions several times. Thanks to Floris for his assistance in helping me to verbalize exactly what it was I wanted to say and looking for a structure in the chaos. Thanks to Dad, Mom, Liz and James for ploughing through the drafts and helping me to cut, cut, cut it down to size. Thanks to my room-mates, Rob and Debs for their support and willingness to offer opinions and advice at all hours. Thanks to Matt, Dad and Mom for the raging arguments and assistance in many ways. Thanks to Buddy and Eileen, for helping me to survive architecture studios in Berkeley with some shreds of confidence left intact and for teaching me a few fundamental of drawing, like how to draw (vaguely) straight lines.

Contents

[List of illustrations](#)

[1.0 Introduction](#)

[1.1 Structure](#)

[1.2 Core principles](#)

[2.0 Quality of Life](#)

[2.1 Right Livelihood](#)

[2.2 Bioregionalism](#)

[2.3 Commons](#)

[2.4 Commons and nature in ritual and celebration](#)

[3.0 Patterns in nature](#)

[3.1 Observation of nature](#)

[3.2 Chaos and systems theory in relationship to permaculture](#)

[3.3 Fractals and edge effect](#)

[3.4 Understanding patterns](#)

[4.0 Observation underlying design](#)

[4.1 Mapping and spatial understanding](#)

[4.2 Time and form](#)

[4.3 Process of design](#)

[4.4 An approach for implementation](#)

[5.0 Application of natural patterns to design](#)

[5.1 Implicate wholeness and patterns of change](#)

[5.2 Spatial understanding](#)

[5.3 Nodes](#)

[5.4 A sense of belonging](#)

[5.5 From disconnection to integration in building design](#)

[5.6 Urban planning](#)

[5.7 Levels of scale and density](#)

[5.8 Fractal branching: from disconnection to integration](#)

[5.9 Crenellating the edge: urban rural integration](#)

[5.91 Webs of wild life](#)

[5.92 Pattern of Sustainability, an example](#)

[6.0 Patterns of production](#)

[6.1 Value adding to resources and job creation](#)

[6.2 Industrial ecology](#)

[6.3 Living machines](#)

[6.4 Energy](#)

[6.5 Agriculture](#)

[6.6 Elements of agriculture 6.6i Soil 6.6ii Trees 6.6iii Animals 6.6iv Water](#)

[7.0 Patterns of social structures](#)

[7.1 Money](#)

[7.2 LETS](#)

[7.3 Networks of information and nodal education](#)

[7.4 Decentralised government](#)

[8.0 Conclusion](#)

[8.1 Difficulty of predicting the future](#)

[8.2 Learning as you go along](#)

[8.3 Self realization through positive action](#)

Bibliography

Appendix

List of illustrations

1 [Comparison of permaculture and conventional agriculture](#)

2 [Fractal patterns increase edge effect](#)

3 [Crenellating the edge - deep interlock](#)

4 [Increasing edge in design](#)

5 ['Do-nothing' year - get house and garden in order](#)

[6 Dense nodes - coalescing from flow](#)

[7 Nodes of human settlement connected by rail and cycle paths](#)

[8 From disconnection to integration in building design](#)

[9 Ambiguity - indoor outdoor connections](#)

[10 Identifiable neighbourhood, embedded in town, embedded in larger whole](#)

[11 Fractal branching of paths](#)

[12 Crenellating the edges of nodes - agroforestry and industrial ecology](#)

[13 Networks of waterways, windbreaks, hedges - edges](#)

[14 Webs of wildlife](#)

[15 A pattern of sustainability](#)

[16 Detail of a node and wildlife web](#)

[17 Increasing the potential of agriculture - five dimensional thinking](#)

[18 Inter-relation - human activity and biodiversity](#)

1.0 Introduction

1.1 Structure

The aim of this work is a cross-disciplinary integration of ideas specifically relevant to permaculture design and the physical structure of human settlements. Although this work is ambitious in scope, I feel this is an important element of the writing, to present an overview such that the reader is able to see the inter-relations of many ideas relevant to design. This is a synthesis of a kind which I believe has so far not been attempted.

Ecological design principles are illustrated through a consideration of a variety of topics, such as urban-rural planning, agriculture and economic systems, hence a general appreciation of the application of permaculture is achieved.

The first section of this work uses the idea of quality of life to define alternative possibilities for working, and for a different relationship between people and the natural environment. The second section is about the patterns of nature which provide the wisdom for permaculture design. The third section describes the observation underlying this design. As nuances of patterns in nature are infinitely varied, permaculture must begin with the local environment. It follows that a permaculture lifestyle would not arise from a ready-made plan, but would involve an on-going process of learning from nature. This process of learning alludes to archetypes underlying patterns, but defies definitive description.

It is the application of these underlying patterns to design which is the basis of the fourth section. This deals with the way in which insights from chaos theory and ecology could effect the design of human communities using the idea of a pattern language. The fifth section is about the processes through which humans interact with natural systems and obtain their needs. This is very important, as it is our methods of production which cause a good deal of environmental degradation. The sixth section is concerned with what effect these changes in design could have on social and economic structures. As these economic structures could also be seen as a catalyst for change to a more sustainable community, there is a cyclical relationship between the physical form of society and its social structures. The conclusion seeks to identify ways in which people can begin to make changes in their lifestyle to move towards a permaculture system.

[Back to the table of contents](#)

1.2 Core principles

Permaculture is a design system which actualizes an environmental ethic, and which enriches the quality of human life by learning directly from nature. In this context, the term quality of life is a broadly inclusive concept which recognises that human well-being is inextricably linked to the health of the land.

"Permaculture is a philosophy and a practical approach to sustainable design in all aspects of life. It is a framework upon which to hang the ideas from many disciplines, an integrative method which enables us to design systems in which all elements work together in an integrated whole, including people, plants, buildings, animals and natural forces such as the sun and wind." (Tippett, 1993).

This is not intended as an introduction to permaculture. The appendix contains a short summary of the basic principles of permaculture design.

Permaculture ultimately transgresses a debate between an anthropocentric or biocentric view of nature, as it adopts a non-dualistic view of humans and nature, where there is no division between people and nature, such that nature does not become a space hypostatised as 'other' and not 'me'. Instead, "to preserve the integrity, stability and beauty of the biotic community" (Leopold, 1949: 224 - 225) is seen as a integral to preserving a viable human community.

Inherent in much of this writing is an acceptance of many critiques of industrial-consumer society. I use this term to mean any society which is based on high levels of industrialization within a free-market, growth economy. I am aware that there are some problems with critiques of modern society, and that there is a danger inherent in over-romanticising the past and non-Western cultures, giving the impression that we could return to a golden, or innocent age. I do take for granted the fact that there is some substance in various critiques of modern society, and that it is possible to design an alternative, including ideas from the past and different cultures. I am making the assumption that fossil fuels will become more scarce and more expensive and the pollution caused by their indiscriminate use cannot be continuously borne by the environment. In this context, many of the ideas in this dissertation which could seem to be impractical can be seen to be eminently practical.

At the very least, I feel it is important to attempt a description of an alternative way of life, rather than simply accepting society the way it is. This thesis is not meant to represent a blueprint for a better way of living, but rather to spark creative thoughts so that people can solve their own problems.

Two core principles provide the fundamentals of the argument for why we should incorporate natural patterns into community design and life-style: Belonging and Practical Wisdom.

Belonging: It is possible to improve quality of life through a greater sense of self through identification with place. An integration with the land through permaculture can be seen as exploring the full potential of what it is to be alive, and expanding the identity of self through identification and interaction with natural processes. The most important thing is to become more aware of our surroundings, more aware of the very physical stuff which makes up our lives, and to question whether or not the way we are living is enhancing or destroying health. Through a means of living within natural systems, we can become attuned to a wider sense of belonging within a biotic community. In the process, human communities are allowed to evolve and develop a sense of community spirit, joint achievement, and unique local culture. The development of right-livelihood in employment, the empowerment of individuals to make changes and the releasing of free time to create, can help to foster a broad sense of belonging and individual self worth.

Practical Wisdom: The bulk of this dissertation revolves around practical wisdom; how we can live sustainably and introduce new systems of agriculture, economics and politics, and how to redesign communities to maximize the role of natural processes and cycles.

Permaculture is not an impractical plan. This is due to the ability to apply ideas and make them happen on a small scale. It claims that alternative ways of thinking and living only become possible if they are acted upon in our day to day existence. The revolutionary aspect of these ideas is that 'small is beautiful' and that the collection of many small actions goes towards changing the whole. These ideas would not be imposed from above by politicians, but enacted by individuals working to improve their own areas. A process of self-realization is encouraged through the actualizing of patterns in nature, not through following a ready-made plan of how to live.

[Back to the table of contents](#)

2.0 Quality of life

One of the main directives of permaculture is to reconsider quality of life. Quality can be defined in many ways. Advertising tells us that we need to have many things in order to be happy.

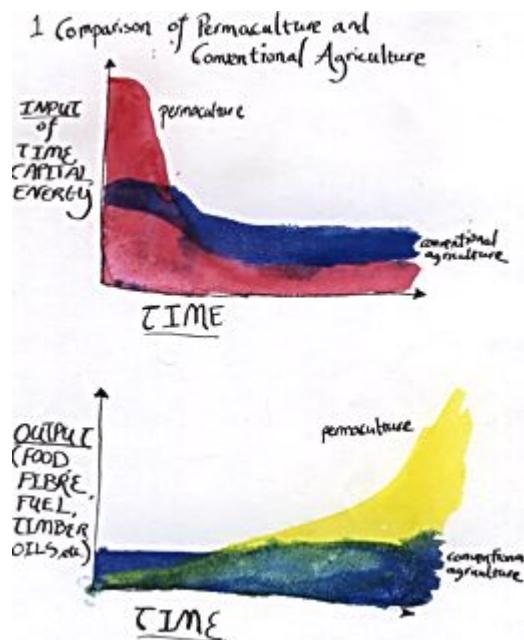
Quality of life could be defined as having control over how we spend our time. Time spent with people and engaged in pleasurable activities could be seen to enhance quality of life. It could involve a high level of sensual enjoyment from the surroundings, from smell, touch, colour, form and beauty and from contact with natural processes. By realizing how strong a hold a material evaluation has on our conceptions of quality of life, and offering an alternative version, permaculture can offer a way for a high quality of life to be enjoyed by all without degrading the environment. I would

suggest it is important to really question what one conceives as quality of life and not to accept definitions fed to us through the media and advertising.

Any move towards sustainability would require a reduction of consumption in industrial-consumer society. Hawken suggests that a move towards sustainability in commerce would have to "reduce absolute consumption of energy and natural resources among developed nations by 80 percent". (Hawken 1994: 55). If people were to buy fewer material goods, they would need less money. This could mean that they were able to work less and have more time. In 1822, William Cobbett said "The man [sic] who, by his own and his family's labour, can provide a sufficiency of food and raiment, and a comfortable dwelling place, is not a poor man" (Cobbett reprint 1979: 3). To bring this to modern sensibilities, I would suggest that a person who was able to provide for their sustenance within a community would be able to survive with less 'real money', or national currency, and would be able to define the terms of their employment and the way they spent their time more easily.

Without fossil fuels and power machinery, it can take a lot of human effort in order to create a product, therefore it is likely that there would be little waste of resources. If it took a long time and a lot of physical effort to chop a tree down with a hand axe, it is likely that a use would be found for every part of the tree and none would go to waste. Modern technology and the use of fossil fuel and nuclear energy mean that we can make products with very little human input. This allows a high level of waste and consumption, as it is easy to make things and easy to buy something new. Technology and fossil fuels can provide a high quality of life with a lot of material goods and little need for human input. Some of the problems with this idea lie in the inequitable nature of this quality of life, it is only possible for a small proportion of the world's population, and the fact that it is not sustainable in terms of the amount of damage it does to natural systems and the environment.

Permaculture aims for a high quality of life by designing within natural systems. There is an attempt to reduce routine work through good planning and arranging social structures which allow people to work together. This could enable society to function without a high use of fossil fuel, without returning to a system of high work loads and hard, continuous physical labour. In permaculture, there is a principle of doing high quality capital work to set up a system, in order to avoid continuous waste of time and energy later on. Permaculture systems can initially be more work than conventional agricultural systems, but this diminishes after the initial structures are in place and the system is able to self-organize and self-regulate.



[Back to the list of illustrations](#)

Permaculture design aims to replace the use of fossil fuel and unnecessary, tedious work through the application of knowledge, information and observation of natural processes. This process involves becoming more humble in our role in the natural environment and learning not to create unnecessary work, which often only ends up in further work creation and degradation of natural environments. Part of this process involves rethinking what it is we need, and realizing that it is important that the materials we surround ourselves with are beautiful and have a sense of quality. This involves turning linear flows of waste and degradation into self-regulating cycles which enhance the quality of the environment and regenerate natural potential and health of the land, water and air at the same time.

Permaculture aims to create a diversity of possible lifestyles. Just as diversity is seen to be important in ecosystems, diversity in human culture is important. People could also have a diversity of jobs at any one time. Although cities and urban areas would still be important, sustainable permaculture practice needs people to live on the land. Human input is an essential part of permaculture systems. People feel less isolated and are able to achieve more as groups. This is where permaculture differs from the self-sufficiency ethic, where the ideal was one family living on five acres and growing everything they needed. Permaculture aims more for local self reliance and co-operation among people, which is a more attainable and sustainable goal.

[Back to the table of contents](#)

2.1 Right Livelihood

"Work is the health of love. To last, love must enfllesh itself in the materiality of the world - produce food, shelter, warmth or shade, surround itself with careful acts, well made things. "(Berry 1991: 58).

There is a deep isolation and disconnection at the root of much of the work done in industrial-consumer civilized society. We are surrounded by materials which have been mass-produced with very little sense of craftwork or aesthetic involvement on the part of the producers. These things are then readily disposable, as they are neither very beautiful nor cherished. Many of the materials used in this manufacture are toxic and have a high-embodied energy, both in manufacture and transport.

I watched a local news programme called *North West Tonight* after the Pergau Dam scandal broke in England. A large dam was being built in Malaysia with British money in exchange for arms trade with British companies. The news issue was largely devoted to the problems the scandal would bring to the North West, where a large proportion of the economy depends on British Aerospace and the manufacture of arms.

Many people were being laid off. A man who had lost his job was interviewed and thought it was terrible, men had worked there all their working lives and didn't know how to do anything else. I found this particularly significant. These people were dependent on a large company for their living, and had no idea of how to work in any other way. Many people feel they are incapable of producing meaningful products for a community through their own efforts.

In this programme, there was no questioning of what type of work these people were doing. There was instead an overriding concern with employment, with having a job and with production for the 'health of the economy'. This concern with the issue of employment obscures questions such as "What effect does the work being done have on the health of people and the environment?" In industrial-consumer society, the value of work is often disembodied from the use of a product. I would question what effect work which has a negative social, ethical and environmental value has on the people who are doing it. In the concept of right livelihood, one aims to look at issues in their entirety, assuming that it is important to feel good about what work one is doing and the effect the work has.

Wendell Berry has said:

"It may turn out that the most powerful and most destructive change of modern times has been a change in language: the rise of the image, or metaphor, of the machine.... mind as computer, one's thoughts are 'inputs', other people's responses are 'feedback'. And the body is thought of as a machine. "(Berry 1991 :76).

We are asked to work faster and to produce more things, subsuming our bodies to the rhythms of machines. "Workers are simplified or specialized into machine parts to do the wage work of the body."(Berry 1991: 37).

An alternative to this is to re-introduce an idea of craft work. A contrast to working with machines is given in this description of work.

"Craft-work was and is often accompanied, stimulated and vitalised by work songs... Each craft has its own set of songs, attuned to its special rhythms....The songs, in fact, supply the equivalent of mechanical energy, with the difference that they uplift the singer" (Hart 1991: 102).

Quoting from Massingham, in *The Curious Traveller*,

"No higher wage, no income , will buy for men that satisfaction which of old - until machinery made drudges of

them - streamed into their muscles all day long from close contact with iron, timber, clay, wind and wave, horse strength. It tingled up in the niceties of touch, sight, scent." (in Hart 1991: 104).

A shift from machine produced goods to craft work can allow people to work at things they enjoy. Much work can be unrewarding in modern society. Permaculture aims to reduce the amount of unrewarding work and drudgery and to increase high quality work which people enjoy.

It is important to realize that this craft work can also be very hard work. Permaculture is not about romanticising a golden age, but rather an attempt to re-define the way in which we work and to think of the importance of an integration of art and life. In industrial-consumer society, we have seen a tendency to separate beauty and function, art has become an elite occupation which is seen as an extra activity, not essential. Art is something the ordinary person goes to see in a gallery at the weekend, not an entity which has direct relevance to and importance in everyday life. Permaculture aims to create a society where work is seen as art, where beauty and function are intertwined, and people have a part in creating the objects with which they are surrounded. Beautiful surroundings and articles are important and the work which people do should be seen as artistic and creative. This relates to an idea held in Balinese society, "We have no art, we do everything as well as we can" (Todd, 1984: 97) This concept suggests why their daily life has the "precision, creativity and uplifting carefulness of an artform" (Todd, 1984: 97).

Craft products are often considered to be too expensive for many people to buy craft products, and a luxury in which only the rich can indulge. Therefore, a move towards a craft industry could be seen as an elitist impracticality for most people. I would suggest, however, that craft products are more expensive than factory products largely due to a false economy based on artificially low prices of fossil fuels. As fossil fuels become more scarce, they may become more expensive. This would be intensified if the price of fossil fuel was to reflect the true environmental cost of their use.

Industrialization and an increasing use of technology in production has often meant a reduction in employment. Unemployed people do not go away. No matter how much they are ignored, they cost the state, either through increased cost of social benefits or increased crime brought on by despair. Traditional economists often argue that we must continue to produce goods in the industrial economy, as it takes too long and costs too much to have people working without the help of machinery. This thinking is sustained by the myth of abundant fossil fuel energy and a lack of will to replace machinery with people. There are many people without work who could be employed making beautiful goods for people to use and treasure. This would entail a reduction in consumption in terms of turnover and quantity. An increase in the quality of the material goods we surround ourselves with could help lead to a reduction in the throw-away mentality we have been programmed into. Permaculture aims for a full employment of people who are able to work, within a framework of each person not having to work too much or for too long.

Many people feel a need to be creative. This can be seen in the popularity of classes teaching crafts such as pottery and wood working. Permaculture aims to introduce the idea of craft work being a central means of production, not simply an extra which we do to fulfil a creative urge. It is possible to provide workshops for many crafts (such as wood working, furniture making, pottery, tapestry, spinning and weaving) if communal resources are used. This can be done through village halls or community centres, or on a smaller scale through co-housing units. This could be seen as investment to create employment.

A replacement of machinery with people is important to the way in which we farm. There is an important link between size of farms, farm machinery and unemployment. Skill and care are replaced by fossil fuels and fewer people are employed on the land. A paradox in industrial- consumer society allows us to wonder what to do about unemployment, but not link this problem with the fact that there are few people working the land. In a time of increasing unemployment it seems to make sense to look at ways of employing more people on the land.

[Back to the table of contents](#)

2.2 Bioregionalism

We are able to travel very quickly and far in modern society. One aspect of this ability has been a "social mobility that has estranged us from our land" (Berry 1991: 49). The aim of bioregionalism is to encourage a deep sense of place and rootedness. Bioregionalism aims to develop a sense of belonging to a community and a place, including an area's biotic and animal community, such that people look after and care for their own area. This is seen as a deep identification with the land and natural processes, embodied in an understanding that the health of people and the health of the community is intertwined with the health of the bioregion and its natural resources.

Bioregionalism offers an alternative to the arbitrary nature of political divisions and boundaries. It encourages a sane use of local resources, proper management of wildlife and the development of healthy, co- operating communities.

A bioregion is a division of land based on geographical, cultural and historical factors. Factors which can be taken into account include: watershed and water supply; landforms and soil types; vegetation types; and cultural factors, such as regional dialects and different customs; or shared concepts of belonging to an area and group of people.

A bioregional ethic involves increased regional and local self-sufficiency. Growing the food required and developing local crafts and building techniques to meet local needs can help give people a high quality of life secure from the vagaries of a world market. This leads to a vastly decreased trade across bioregions in material goods, with a corresponding reduction in international trade of goods. Movement of goods across large distances is inherently wasteful of energy and resources, and often entails exploitation.

An enhanced exchange of ideas, information and cultural wealth would be encouraged in order to avoid stagnation and increase the knowledge available to people working within a sustainable framework. Satish Kumar suggested that which comes from the soil, the material goods which fuel a society, should be produced and consumed locally. There is an enrichment of human culture and understanding if ideas and cultural patterns are shared. He spoke of the lunacy of importing Danish cookies to America and importing American cookies to Denmark, and suggested it would be more efficient to exchange recipes. Thus there would still be a transfer of ideas and culture, but not an energy-expensive transfer of resources. (lecture, Dec. 4, 1993 at Lancaster University).

Local production of goods has some less obvious advantages. If food production, industrial ecology and craft work are integrated with housing and amenities in a community, people would be near to many different processes. They would be able to see, hear, smell and feel food being grown and experience the making of craft products and materials. This connection with the processes of growth and production could help to heal some of the alienation and disconnection felt in modern life.

Old and young people could be involved in some of these processes, thus feeling important to the community. The raising of children can be integrated into a community through combining housing for old people and day care and play facilities for children. There is an imbalance in society when people complain that there are not enough child care facilities, and at the same time old people are often seen as useless and under-valued members of society. There is often an affinity between old and young people. Old people frequently have more time available to spend with young people, and are able to feel useful and valued for their knowledge, and young people are able to feel loved and integrated into a community wider than a nuclear family.

In a local economy, it becomes easier for people to work fewer hours and to spend less time commuting. This would make it easier for both men and women to have a part in raising children. This could be one way of healing gender inequalities in the work-place and home.

The work of a bioregional group includes assessing the region in order to identify drains of resources out of a region, such as water, soil, money and talent. Having done this, it is important to develop local self-reliance strategies. It is possible to begin a process of re-inhabitation which involves getting to know the place and developing a sense of an identification with natural processes and people in an area. Part of this process involves rehabilitating natural areas and creating new areas for indigenous wildlife. Community forests can be developed, skills and knowledge can be pooled to work for the good of the bioregion and its people. As a database of knowledge about the region is built up, and as community meetings and ways of disseminating information are established, it becomes easier for people to know what is available in an area and to access it.

One of the important elements in bioregional organisation is a re-assessment of inequities in terms of land ownership and access to resources. There is a possibility that more land and resources could be owned and managed communally if strong local forms of organisation, communication and government are formed. This leads into the idea of the importance of communal ownership and management of land and resources to a sustainable future.

[Back to the table of contents](#)

2.3 Commons

"The first man who, after fencing off a piece of land, took it upon himself to say, "This belongs to me" and found people simple minded enough to believe him was the founder of civil society." (Rousseau, Pleiade, vol. 3 p. 164).

One of the gravest inequities in society has been that of control over land. In England, access to common land was severely restricted with the 'Enclosure Acts'. Communal land is essential in permaculture for the creating of forest and water systems within a regionally integrated management plan. With increased co-operation between people it becomes more feasible to create integrated systems due to an increased skill and resource base. It is easier to make changes as part of a group.

Communal ownership of land is not a new concept, the village community with communal access to land

"prevailed in England during both the Saxon and Norman times, and partially survived until the last century. It was at the bottom of social organization of old Scotland, old Ireland and old Wales. In France, the communal possession and communal allotment of arable land by the village folkmoor [or village council] persisted until the first centuries of our era". (Kropotkin, 1902: 106) .

In an ideal permaculture design, each household would have its own private garden and the rest of the community's land would be held in a trust. There would be no large scale individual ownership of land. Each community would have institutions to distribute access to land amongst people in the community. It would be possible for more than one person to use different areas of land at the same time for different types of employment. Social forestry would be important. People would have rights of forage in community forests, rather like Medieval rights of pannage, where peasants were allowed to run pigs in oak forest in autumn. Shiva describes the creation of social forestry as being for the benefit of the community, and achieved through "active involvement and participation of the community... The overall concept of social forestry aims at making villages self-reliant in regard to their forest material needs." (Shiva, 1986).

Communal right of access to the land does not inevitably lead to 'the tragedy of the commons,' which Garrett Hardin (1968) predicts for communal resources. This is due to cultural restraints placed on people working within a communal system. "In day to day practice, it was above all the community which exercised dominion over time, space, agriculture and language. Woods and streams feeding local irrigation systems remained intact because anyone degrading them had to brave the wrath of neighbours deprived of their livelihood, and no one was powerful enough to do so. Everybody was subject to everybody else's personal scrutiny and sanctions." (The Ecologist, 1992). The important element in equitable distribution of land and resources within a communal system is the healthy communication between members of the community. Thus a bioregional society would need to emphasize activities which encouraged participation and integration of people's interests.

[Back to the table of contents](#)

2.4 Commons and nature in ritual and celebration

Ritual plays an important function in social life. It offers a way of strengthening community ties and encouraging communal work with festivities. One important aspect of the idea of developing a high quality of life is that work should be fun, and daily living should be an enjoyable event. Work can be a creative act involving a group of people.

Festivals and parties help to make work fun. In pre-tractor days, communal work in agricultural villages was not always seen as a laborious chore, but rather "These days of hard work become fete days, as the owner (of the land being worked) stakes his honour on serving a good meal. No remuneration is given, all do it for each other". (Kropotkin, 1902: 194).

There is a beautiful description of the integration of festival life and work in this description of life in Brittany:

"Everyday life was punctuated by a series of feasts and customs, which corresponded to the collective work: the construction of a building or a harvest were opportunities to kill a pig and drink a lot. Or the ground ceremony; when the mud floor became too uneven or muddy, people from the surrounding farms were invited on a Sunday. A mixture of clay, ashes and cow manure was spread upon the ground to harden it, and the dancing and stomping packed the floor for the next year." (Gac in Shelter II 1978: 43).

In this description an integration of function, achieving a task and pleasure can be seen. Such festivities have the effect of encouraging communication and a feeling of reciprocity amongst neighbours.

Rituals can also offer a powerful means of developing a connection between people and the land.

"Ritual focuses attention by framing: it enlivens the memory and links the present with the relevant past. In all this it aids perception. ...It can permit knowledge of what would otherwise not be known at all. ...There are some things which we cannot experience without ritual. Events which come in regular sequences acquire a meaning from relation with others in the sequence." (Douglas 1966: 64).

We can learn dances and songs which teach of the seasons and harvesting, of the types of plants and their uses. Harvesting and preparation motions could be translated to dance movements, with words of the song to tell about the

plant and its uses. "In celebration, we can incorporate the myths and skills that are important to future generations." (Mollison, 1988: 46). This form of learning enables us to remember many types of knowledge easily and could be a powerful tool in learning how to live sustainably.

Tree planting rituals can have an important function in integrating people and land, and in marking stages of a life cycle with festivities and action. Andre Strathern describes a ritual among the Melpa of New Guinea:

"The person as an amalgam of body (*king*), mind (*noman*) and soul (*min*), has to be rooted in a particular locality, just as the body has to be buried there. This idea of "rooting" the person is expressed in the cordyline ritual, which is performed soon after childbirth. At this, the child's navel string and the mother's placenta are buried together; and a cordyline or banana tree is planted on the spot. The father is supposed to do the planting and to construct a fence around the cordyline. The fence is called the child's faeces fence (*te angambokla te pakla*), since ideally faeces which the child produces while still of an age to be drinking from the breast (up to three years old) should be thrown inside it. As the plant grows, so the child will grow.The navel string, which once connected the child to the mother in the womb, now connects it to the earth and this link is represented by the cordyline tree, which in several Melanesian cultures is a plant that marks the boundary between life and death." (Strathern, Andre in Bloch and Parry (eds.) 1982: 119-120).

This description shows a simple ritual which serves to root a person to the land. This is not simply an abstract idea, but is embodied in the form of a tree which is fertilized by the child's faeces, thus a physical and metaphorical connection is created between person and place.

We could develop rituals for tree planting in order to mark the stages of our lives. This would not only offer a time for reflection and encourage an awareness of change, it would also help to encourage the planting of trees and an understanding of the importance of being involved in regenerative work. Some suggestions for ritual tree plantings follow. At birth a fruit tree could be planted to produce food for the new member of the community, at adolescence (a stage which is relatively unmarked in our society by any important rite of passage), fuel trees (such as willow for coppicing) could be planted in order to provide energy for the growing adults as they use more energy and move into their own homes.

In Celtic mythology, eating the magic hazel nut would imbue a person with enhanced insight and wisdom. Nut and fruit trees could be planted at important points in the educational cycle (such as graduation from college). It is possible to imagine University campuses as great fruit and nut bearing forests, with trees planted by successive generations of students marking their passage through the institution. The fruit and nut harvests could help to supplement the generally poor diets and low budgets of the students. At marriage the planting of timber trees could provide an income for retirement. The planting of such trees could mark a couple's commitment to providing for each other throughout life and to being responsible members of the community.

At death, trees which help to restore degraded lands and native forests could be planted as a gift for the future and the renewal of the life of the community, wildlife and soil. This model could also provide us with a means of providing a positive outlet for grief. The planting of memorial groves would give a quiet and peaceful place to remember and to commemorate, as well as helping to clean up the environment in an effort to pursue positive health through clean air, soil and water.

Thus celebration and ritual can provide the glue for cementing a sense of place and belonging with the land and within a community.

Through questioning what determines quality of life, it is possible to envision a radical restructuring of work and employment patterns, and to see a possible new form of regional and community organisation. For the design of the physical structures of a new community, it is important to learn from natural processes.

[Back to the table of contents](#)

3.0 Patterns in nature

3.1 Observation of nature

Permaculture has much to teach us about designing systems for obtaining our needs. This is important in sustainable design, as it is the way in which we obtain our needs which degrades ecosystems at an alarming rate. Priorities in permaculture include saving what natural areas we have left from further degeneration, and regenerating what we have previously stripped of ecological wealth. One of the main directives of permaculture is to reduce the amount of land we need to supply our needs to a minimum, so that we can return as much to natural areas as possible. This is important in order to ensure long term ecological viability and health of ecosystems. It is understood that the health of human communities is intimately connected to the health of natural ecosystems, both in terms of continued supply of resources

and an unpolluted environment. In permaculture people take part in their ecosystems, instructed by natural processes and becoming a part of them.

Observation of nature can give many insights in the form of practical wisdom and understanding patterns of events and forms in order to embody them in design. From a careful observation of the functioning of ecosystems we can learn wisdom for an alternative way of how to live. Asking questions such as: "what are their characteristics, what are the forms and structures, relationships?", allows design to be based on patterns in nature.

This is not a simple task, as it must be remembered that there is no clear line to be drawn between nature and human culture. Ideas of nature have been culturally conditioned to the point where it is possible to talk about an objective understanding of nature through science. Permaculture is more about developing an empathy with natural processes, rather than an arrogant conviction that one understands the whole of an objectified nature. It is about an attempt to observe without judgement and to feel with all of the senses. One advantage of permaculture design could be described thus, "By designing well and then by observing system evolution, we gain contemplative ... time. In contemplation, we find more refined, profound, or subtle insights into good procedures." (Mollison, 1988: 46). At any one point in time we may not be doing what is absolutely the best for the land, however by reducing the need for routine work in obtaining our needs, we are able to spend more time observing ecosystems and learning how best to work within a natural framework.

One of the ways in which we can learn from nature is through the understanding of patterns and forms. A study of the forms elaborated in chaos theory can offer some insights into sustainable design strategies.

[Back to the table of contents](#)

3.2 Chaos and systems theory in relationship to permaculture

"*Entropy's worse enemy is life itself*" (Gleick and Porter, 1991: 34).

Capra (1983) has explained many of the links between a scientific world view and Western culture's paradigms and social institutions. Many writers (Capra, Shiva, et al) have identified tendencies in the modern world-view to fragment nature into parts of a machine, which can be understood separately as discrete entities, and in which connections are not considered to be important. This attitude violates the integrated and interconnected fabric of nature and leaves us with a world-view which is incomplete and incapable of understanding ecology and our intimate connection to the earth. Shiva suggests that these divisions and "the reductionist and universalizing tendencies of [much of modern science]...become inherently violent and destructive in a world which is inherently interrelated and diverse." (Shiva 1989: 14).

Much of modern Western thinking has divided "the world into equally fragmentary facts and events. [This system of intelligence] stressed the integrity of objects and the independence of ideas. It sets things apart from one another." (Watson, 1991:198). Linear thinking can be understood as only seeing discrete objects and not systems and connections. Only parts of systems are seen in isolation. Thus objects and entities are placed into discrete compartments with few connections to elements outside the compartments. Scientists attempt to find out about nature through measurement.

We tend to think that the best way to travel from A to B is in a straight line. Straight lines abound in our culture: houses, roads, gardens in neat rows, right angular fields ploughed in straight rows for mile upon mile... To our eyes this looks organized. In energy terms, however, it is chaotic. Nature does not grow in straight lines and a lot of energy is required to force them onto nature and the landscape. This energy use comes in many forms; such as the fuel used to drive tractors and to provide herbicides. A lot of energy is expended to keep a vegetable garden weed-free and in neat rows, as any one who has tried such a task well knows. The neat rows and right angles we prune nature into stem from our linear thinking and the desire to place things into neat compartments with no messy edges.

In contrast, permaculture design aims to emphasize possibilities for connection rather than an objectified and compartmentalized view. "The more connections we make between the elements of the landscape on which we depend to meet our primary needs, the more sustainable that landscape becomes." (Hamilton, 1993: 38).

Chaos theory allows a branched, complex form of organization to be understood. This was first described as fractal by Benoit Mandelbrot. The term was derived from the Latin word *fractus*, or shattered. Fractal relationships are coming to be seen as all pervasive in nature, they "govern the arrangement of cracks in a dried mud bed, the blotching of green lichen on a tree trunk, the clustering of galaxies, and the scattering of rocks on a talus slope. (Gleick and Porter, 1991: 72). This is a very important idea. "Fractal geometry is a new language ...[which] reflect[s] our intuitive sense of hidden connections" (ibid.: 23). This branched pattern can be seen as fundamental to form in nature. This has been described as "nature's own symmetry, a symmetry of textures, in which the large mirrors the small" (ibid.: 66). This can be seen in opposition to a very rigid, linear and compartmentalized language of geometry. "Neatness, tidiness, uniformity, and straightness signify an energy-maintained disorder in natural systems" (Mollison, 1988 :31). Thus the amount of energy required by a system, additional to that of ambient solar energy, can be seen as a measure of the designer's pattern

understanding. The space and forms which are created by living processes using the sun's energy are very different to those created by humans using fossil fuel or nuclear energy.

The branched, interconnected and self-organizing systems which are being recognized by systems theory can be created in social structures, production systems, water, waste and sewage flows, in landscape, in urban- rural patterning and in built form. The patterns to learn from can be seen in the form of trees, ecosystem relationships and the way in which water flows. Indeed, "Part of the movement towards understanding chaos has been an appreciation of pattern formation as a specialty in its own right." (Gleick and Porter 1991: 30).

Working within an understanding of systems and chaos theory requires the designer to be aware of many levels of perception of reality, taking the patterns which appear on an atomic level and applying them as an analogy to design and form. This application of patterns at different levels of scale, seen in permaculture at the level of a building, garden, farm and regional planning then at general systems of money and government, can also be seen in fractals. Each level of scale of a fractal shows self similar properties, thus each level of scale is made up of smaller parts of reflected forms.

[Back to the table of contents](#)

3.3 fractals and edge effect

"*Fractals are not just artificial constructs, they shape us and the world we live in.*" (Gleick, 1987).

From a permaculture perspective, one of the most important aspects of understanding patterns is that of the 'edge effect'.

"In nature, there are no rigid borders, the edge is more a diffuse region of exchange, an interchange of elements and a net for new information, in the form of nutrients, seeds or cultural exchange. Edges are extremely important. They are the most productive areas in terms of species as well as actual physical production. At the edge of two ecosystems, species from both systems as well as special species adapted to the conditions of the edge are found." (Tippett 1993).

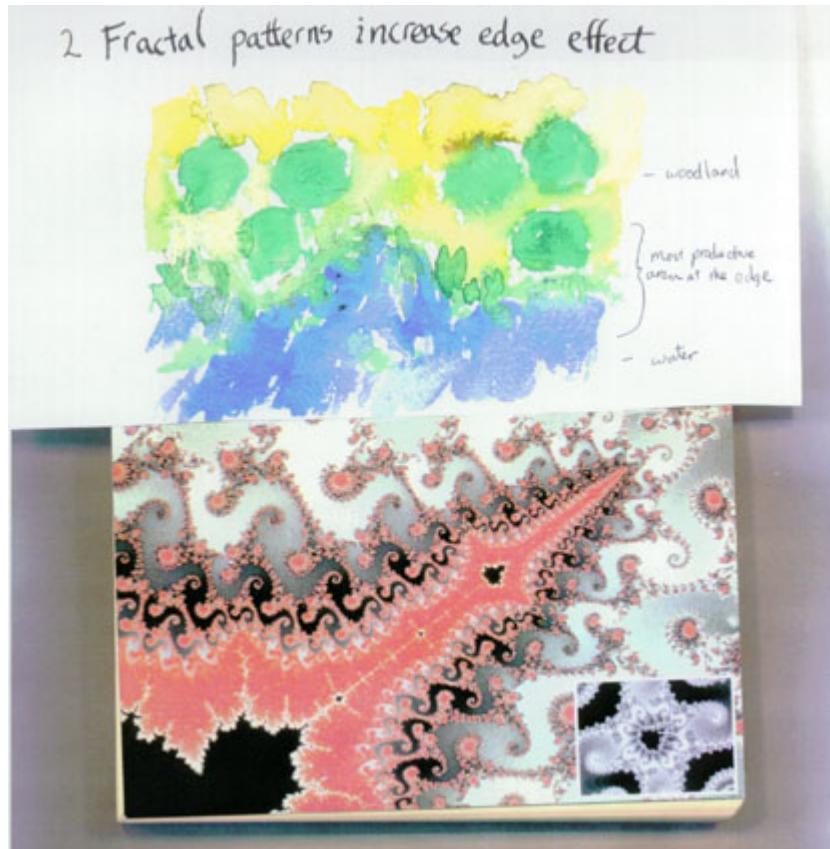
The edge is very important in terms of biodiversity and production of biomass. At the edge, there is an increased cycling of materials and information. There is a possibility for increased synergism, or mutually beneficial relationships between elements of a system. The edge is seen increasing possibilities for creativity, as it is the point for merging, change and new ideas.

Edge effect can be understood by considering the edge of water and woodland systems. Water has many beneficial effects on land, sunlight reflection is increased and climate is moderated, warming up less quickly but staying warm for longer. Productive edge plants (such as sweet rushes, reeds, blueberries) thrive. The water also benefits from the edge with the land, due to the increase in highly productive margin plants and enrichment by nutrients from the land. Tree leaves fall into the water, land animals and birds visit and deposit the richness of their fertilizer.

The edge of woodland is also highly productive. Species are able to receive more light, and soft fruits, vegetables and herbs can thrive, gaining from the additional nutrients and moisture provided by the trees. Many native cultures have learned how to benefit from the edge of forests. In New Guinea, agriculture is practised in clearings in the forest. "A Tsembaga gardener is almost as irritated when a visitor damages a tree seedling as when he heedlessly tramples on a taro plant. The Tsembaga recognize the importance of the regenerating trees; they call them collectively *duk mi*, or 'mother of gardens'.. (Rappaport, R. A., [The Flow of Energy in an Agricultural Society](#)). Agro-forestry offers unparalleled opportunities for increasing the beneficial edge effect between crops and trees.

An understanding of the form of a fractal structure has many implications for design. This is one interpretation of an organizing principle in nature and can offer many possibilities for an alternative structure for society. It is worth asking what happens if you take these forms and push them, using them as an analogy for design, as opposed to drawing straight lines and calculating what will fit onto the site, which is often the method of urban planning. The spire of a Gothic cathedral offers one example of a fractal-like form in design. A fractal form could give possibilities for enhanced life and contact with natural systems. The crenellated edge of a fractal allows a dense packing of space and a large surface area between systems.

2 Fractal patterns increase edge effect



[Back to the list of illustrations](#)

Edge effect can be increased through the use of very distinctive structures, which allow a deep interlock and crenellation between systems. This can be seen in an idea of rural urban integration, where fingers of open areas and countryside are brought into the town. On a physical level there is an elaboration at the edge which brings the two further into contact. This is analogous to a fractal and can be seen to be enriching possibilities of life and growing potential, maximizing the quality of the environment.

3 Crenellating the edge - deep inter-lock

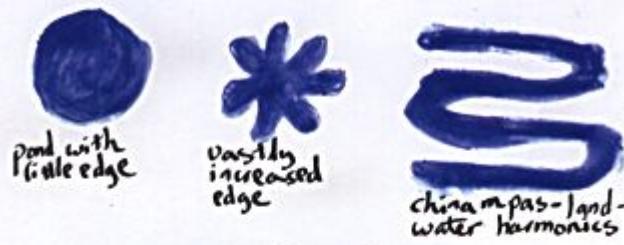


urban-rural fingers-increasing edge

[Back to the list of illustrations](#)

Very linear, compartmentalized structures (such as the square fields imposed on landscapes by petro-chemical agriculture) do not encourage much exchange and flow. Branching structures allow a maximum of edge between elements of a system. This edge enables material flow to take place without a high expenditure of energy. An example of this can be seen in the intestines, where the crenellated surface allows a high level of flow between organ and body tissue. Patterns which increase edge and flow are encouraged in permaculture design.

4 Increasing Edge in Design



Clearings in a forest



increases diversity, sunlight, fertile area for growth
Key hole - beds in garden



1 - frequent use, salad crops etc.
 2 - less frequent, veg. herbs flowers
 3 - main crop, soft fruit

[Back to the list of illustrations](#)

[Back to the table of contents](#)

3.4 Understanding Patterns

The word pattern can be a slippery one. It has a multiplicity of meanings, from a shape, to blueprint, to structure, thread of development or repetition, or a concept. In using the term in this work, I am using it in the sense of understanding underlying structures which inform events and space. This implies that there are simple patterns which are repeated in nature. Many different structures develop from these simple patterns due to different evolutions and conditions in place, however there is a deep underlying similarity between the forms produced. This is similar to the way in which a plant grows according to the patterns in its genetic code. Each plant is moulded by its special conditions, the place in which it grows and the forces which act upon it, but all are similar. This can be seen as analogous to the creation of fractals in chaos theory, where a simple equation is applied over and over and produces different, but self-similar patterns each time. A complex pattern is built up of the interaction of simple parts.

Permaculture is essentially a linking discipline, and involves an attempt to understand underlying forms and the glue between ideas and objects. I see an understanding of patterns and connections as an essential link between insights into the interconnected nature of the world elaborated in ecology, chaos theory and sustainable design. As Bill Mollison, one of the founders of the Permaculture movement says, "An understanding ... of the underlying patterns that link all phenomena creates a powerful abstract tool for designers." (Mollison 1988: 94).

An understanding of patterns can be of use in design in the form of a pattern language. A pattern language is a set of organizing principles which can act as a tool for thinking about sustainability, but should not be applied as a blueprint for design. Patterns must be flexible and responsive to local conditions.

This idea has been developed by Christopher Alexander in *A Pattern Language* (1977), in which he argues that our physical environment is created by the building of patterns which are in our minds. These patterns are dynamic, as they

tell how we may shape the world around us. He says;

"Each pattern describes a problem which occurs over and over again and again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice." (Alexander, 1977: x).

What Alexander suggests has happened to create ugly places in industrial-consumer society is that the language is not shared by all people, "the pattern languages which determine how a town gets made become specialized and private" (Alexander 1979: 231-232). As planners and architects are considered to be the only people capable of designing the environment, design becomes dissociated from process over time and the interaction of nature and people in a place.

This thesis involves an attempt to find a pattern language of sustainability which can be shared by all people. This language could be used to design places on many levels of scale from a window box to a town. This is not a specialist endeavour, but would be built up from the small actions of many people in their own place over time. In this way, there is a sense of the environment evolving and of people being involved in decisions which effect their way of life. A pattern language of sustainability would be built up from observing patterns in nature and in chaos theory. Given a language which shares these insights, there is a potential for human systems to grow in close contact and co-operation with natural processes.

[Back to the table of contents](#)

4.0 Observation underlying design

A creative process of design should involve an increasing depth of experience and perception. Patterns in nature should not be seen as a static blueprint for design. The intent of this thesis is to define what to look at, then how to look and how to go about making changes. The under-pinning of permaculture design is a deep interaction between person and place, and realization that there is an interactive process between our actions and space. 'Form in-forms'. Our bodies inform the buildings we inhabit, as the buildings inform our bodies. This can be seen as a trap or an opportunity. The trap is a downward spiral from much of the recti-linear urban blight we have built. The opportunity is to allow our forms to fill space, and through body awareness (walking, dancing, breathing) learn how to build anew. Gary Snyder asks the question;

"But how could we be were it not for this very planet that provided our very shape? The trees we climb and the ground we walk on has given us five fingers and toes. The "place"... gave us far-seeing eyes, the streams and breezes gave us versatile tongues and whorly ears. " (Gary Snyder, The Practise of Wildness).

Careful observation and making small changes which allow regeneration to occur allows us to learn to follow a process of design and not a set of rules.

[Back to the table of contents](#)

4.1 Mapping and spatial understanding

The way in which we perceive space can be greatly affected by the way in which it is represented. Our perceptions are influenced by maps and images of space. This is not a simple relationship. Not only is the map not the reality, but it must be questioned who is doing the mapping and for what purpose. What is being emphasized, what is being left out?

Maps are usually produced by centralised groups, Hence non- professional people often feel incapable of producing an image of their area due to technological incompetence, and instead rely solely on map companies for such images. There is a problem here, however, as it has been traditionally the case that to map has been to dominate and control. Harvey speaks of how a rise of measurement and mapping in the Enlightenment lead to a sense of control over space, "The mapping of the world opened up a way to look upon space as open to appropriation for private uses" (Harvey 1989 p 228). This is still the case in industrial- consumer society, where "mapping has become an activity primarily reserved for those in power, used to delineate the 'property' of Nation States and multinational companies" (Aberley 1993: 1).

We have "lost the ability to conceptualize, make and use images of place - skills which our ancestors honed over thousands of years " (ibid.: 1). The challenge to us seems to be to think of new ways to represent space. The ability to draw and conceptualize space is an essential prerequisite to regaining control over our own space and to being able to

make informed decisions and changes. Mapping can greatly effect how people perceive possibilities for their area. As Aberley says, "Maps can show a vision for the future more clearly than thousands of words" (ibid.: 4).

As well as the process of wresting control over mapping away from centralised groups and re-learning how to make images of space, we need to question what is being represented. It is important to ask whether relationships are being emphasized, or whether an image shows objects with few connections. Are natural systems being shown? What emphasis is given to the built environment and streets?

We can learn about alternative mapping techniques from non- Western cultures, for example: In Micronesia, "mapping lore is preserved orally in stories, poems, chants, and through rhymes. It is shown physically ...in dwellings whose rafter patterns depict segments of the night sky...In these and many more ways, Micronesians weave information on navigation into their daily lives." (ibid.: 11).

Communities can appropriate mapping technology and incorporate the action of mapping into the process of community building. Aberley suggests that each community could produce an atlas which describes home, with many different types of representations of place. Social evenings could be held in a community hall in relation to the mapping process in which "there are songs, dances and ribald stories, all relating to the occupation of a well-loved territory." (ibid.: 16). These maps can also encourage creative use of media, from sand maps to embroidery and collage.

The process of mapping requires more than technical know how. Conventional mapping techniques have been part of a process of divorcing humans from the world. In the metaphorical sense, maps have become a way of systemizing an understanding of nature as something separate from self. In contrast, "the key to building empowering cognitive maps of bioregions is based entirely on experience in the landscapes and ecosystems of place." (ibid.: 14). A bioregional process of mapping would include walking the land, being a part of it. Instead of simply drawing a river, it is important to go and walk along its tributaries, swimming in the water, sensing its importance to the surrounding area, finding out about the health of the trees in the water catchment area. This is a process of deep identification of self with land, realizing that the river is the water you drink, the trees effect the soil and the food you eat.

People can be encouraged to think about what is important to them in their place. This process often highlights many areas which should be protected from development, as well as areas which need improvement. Children can be encouraged to learn about place and to create images of the community and their place within it. Old people can be encouraged to record some of their memories and events which make an area special. These processes can help the community to learn about processes of change and development and to consider the historical and cultural elements of their area, as well as helping old and young people to feel they have an important place in the community. The group *Common Ground* is doing such work in Britain, working with local groups to create images of place and to develop a coherent sense of what people would like to see happen in their area. (Kim and Clifford, 1985).

Mapping can be an important learning process and methods of mapping and encoding information can facilitate information flow, not only to more people within a community, but also across boundaries of culture and geography. The *biome system* as developed by bio- geographers is based on climate and soil types and "demonstrates the existence of global patterns showing statistical repetition of flora and fauna" (Fiske (Sustainable Design Compendium, Regional Planning and Sustainability): 4). This concept can be very helpful in design. This has been put to use by the *Center for Maximum Potential Building Systems* in Austin, Texas, where they: "have collected scores of catalogues from organizations and groups throughout the world, enabling [them] to scan their collective knowledge base using the spatial coordinate of the biome. ...[Topics covered include] renewable energy, indigenous building materials, arid lands farming, medicinal plants and waste treatment processes." (Fiske (Sustainable Design Compendium, Regional Planning and Sustainability): 7). These information banks can be used as the basis for networking and exchange of information between similar biomes.

The learning process involved in encoding information about place in mental maps of cultural landscape, historical maps and wild life maps is important in design. For example, waterways, areas of natural habitat, soil types and transportation routes can be mapped. In this process, "patterns which indicate relationships will begin to emerge and give a sense of what is linked to what in a given area." (Todd, 1984: 98). From this it is possible to identify possible areas of development, such as where wildlife corridors could be developed, whether or not housing and retail could be developed near concentrations of public transport.

One of the most important first steps in design is to analyse current flows of energy, materials, information, water, nutrients and money. Flow diagrams can be used to great effect in this analysis in terms of identifying patterns. The creation of images of place can facilitate different ways of representing and thinking about flows, relationships and land. This understanding of mapping leads into the need for an understanding of processes of change over time.

[Back to the table of contents](#)

4.2 time and form

Time is intimately connected with the earth and with the way in which it is formed. "History, in fact, is as important as form or structure. To a large extent, the history of a phenomenon is the phenomenon itself" (Bookchin 1983: 23). Form is a result of complex dynamical systems, which flow and change over time. Space is patterned by pulses and rhythms. Time is 'enfleshed' in existence as the history of form. Thus a designer must learn how to join the stream of change, to work within time and see how to reflect change. Design is not seen as a static end-point, such that you draw lines on a piece of paper or a computer screen, then build it and it will stay that way, but rather a dynamic interplay of forces which shape space. The physical structures that a designer puts in place effect processes on the land, and every change has repercussions in the future. Design is seen as a process with in-built feedback mechanisms, rather than a series of events which unfold in a linear progression.

A designer needs to learn how to read patterns as the product of action in the past, of forces acting over time, then realize that every change in space we make effects the flow of energy and materials through a site over time.

Ecological design attempts to work within a framework of seasons rather than imposing a monotony upon time. There is a recognition of the passing of days and cyclical time. The word agriculture means:

"cultivation of the land. And cultivation is at the root of the sense both of culture and of cult. The ideas of tillage and worship are thus joined in culture. And these words all come from an Indo-European root meaning both 'to revolve' and 'to dwell'. To live, to survive on the earth, to care for the soil, and to worship, are all bound at the root to the idea of a cycle." (Berry, (1991: 10).

Buildings and urban design should be responsive to the seasonal and diurnal flow of time. Building form should reflect responsiveness to the sun, orientated for the maximum heating and day lighting. This is rarely the case in modern cities. As Ralph Knowles states, "Form in nature bears the impact of rhythmic variation...There are few indications of rhythm in our urban forms. The modern city is a place where time is read from the face of a clock, not from natural clues. " (Walter et al 1992: 85).

[Back to the table of contents](#)

4.3 Process of Design

Design needs to be responsive to local conditions. In order to do this, a designer needs to be receptive to the forces acting on site, a receptor of information from all the senses. "We are all the eyes and ears of the earth; and we think the world's thoughts". (Watson, 1991: 36). Sensitivity is an essential tool in permaculture. Design springs from observation without judgement. Action is prefaced by wide-eyed observation and an attempt to understand the processes at work in shaping the landscape and ecology.

All design must have roots in present, history and future. It is important to learn from the history of a place, to discover if possible what plants have traditionally been grown in an area and what the traditional crafts, land use patterns and customs are. This can be learned in many ways, from studying old maps and documents to looking for archeological and historical evidence. One important resource is the old people in an area. It is also important to talk to neighbours and local people who are currently involved with the land as there is no point in repeating mistakes and not learning from the experience of others. Information about a site and its potential resources is gathered through observation, walking in an area, examining soil and climate maps and records of historical uses of the land and finding out about characteristic vegetation types and mature ecosystems.

Design should be a fluid process, as it is impossible to take all variables into account in one go. Allowing a site to begin regeneration and leaving it undisturbed for a while can give many valuable insights. Watching which species grow where gives an indication as to what design strategies would be appropriate for that area.

A general overall design is important to determine possible patterns of land use incorporating zone and sector analyses.(see appendix). As parts of a design are implemented, however, the changes which are made affect the whole. If a responsive design process is being carried out, this would change the overall design. It is not enough to draw pretty lines on a paper and then presume everything will be followed through to a grand master plan. Instead, it is better to identify easy changes to make and do them, then observe what effects any changes have on the overall workings of the land, before making further changes. It is very important to keep a momentum of action and to have some results which are visible and encouraging. A fluid process means the designer is less likely to make mistakes due to incomplete

knowledge and is more likely to make full use of the potential of a site.

Trigger elements enable changes to happen by acting as facilitators. This involves understanding how to make the minimum change for the maximum effect. One example of this can be seen in dry-lands with a high rate of erosion. It is possible to build stone walls across erosion gullies. During the rainy season, water carries silt particles downhill. Upon reaching the stone walls, the water is slowed down, and the silt particles are deposited in the gaps between the stones. After one year, this will create a fairly waterproof dam, which will hold run-off water, stopping its destructive flow and causing it to infiltrate into the ground. The increased ground water allows the planting of trees which will make use of the water throughout the dry season. Trees attract moisture and build up soil. From the simple action of building stone walls, it is possible to reverse the damaging process of erosion and to establish trees. This is a much easier and more effective way of going about halting erosion than the building of concrete check dams, which are expensive and are often ineffective against the force of run-off water.

This idea of trigger elements which act to begin a process of ecological regeneration can be seen as a mirror image of the threshold effect which is often cited in eco-doom scenarios, where it is said that ecological systems can only take so much degradation, then they will change catastrophically. Biological systems are dynamic and can have incredible resources as well as an inbuilt fragility. From this understanding, it can be seen that human actions can effect the environment in a non-linear form, when causing damage, thresholds can be crossed which send the system into a cycle of degradation or regeneration. Sensitive designers learn to work within systems theory and the resources and resilience of ecological systems. This involves inserting elements which kick-start a process of regeneration.

Diversity is an important element in ecosystems. This involves both a diversity of species and a development of resilience through inter-connections. As a system evolves, there is an increased ability for species to live in a mutualistic (not competitive) fashion and linear food chains develop into more complex food webs. (Fiske (Integration Compendium, Integration versus Conservation): 2-3). Stability of a system is not a rigid robustness, but rather an ability to adapt. Thus, a multiplicity of possibilities and perturbations can be absorbed and channelled to creative effect. It is not only the number of elements in a system which increases stability, but also the number of connections between elements, or the degree of integration involved in the system. "Ecological wholeness is not an immutable homogeneity, but rather the very opposite - a dynamic unity of diversity...balance and harmony are achieved by ever-changing differentiation, by ever expanding diversity" (Bookchin 1982: 24). It is important to allow for this natural spontaneity and creativity in design.

The role of a designer is to allow for evolution and for systems to follow their own internal dynamics. Instead of trying to impose our ideas on the site, we should set up nets and trigger elements to effect a change and provide many options and raw materials for this change. These raw materials include a diversity of plant and animal species, in particular native varieties. Water is a great former and carver of land. Where possible, water should be encouraged on the site through rainwater collection and the digging of ponds.

[Back to the table of contents](#)

4.4 An approach for implementation

The principles of adaptive design elaborated above can be seen at work in a plan for developing a small area of land as a permaculture farm. This approach to developing a site aims to make the best use of time and resources and to allow the site to develop as much as possible according to its inherent logic, or own evolution.

- I. One of the first steps in implementing a design is to get the house and garden properly in order, while taking a lot of time to observe the land and to watch it change over the seasons. It is important to walk around, listen, smell, feel, look, and absorb as much information about the site as possible. This enables a design which will make the best use of the resources available, as they become better known. It is important to be very sure before making any decisions which will be expensive or take a lot of time and energy to implement.
- II. Stabilize all areas of erosion and degradation of the land. Allow natural regeneration to take place, observe. One manifestation of an understanding of systems evolution allows the permaculturist to achieve results with less effort. For example, weeds are very useful species. They help to re-mineralize degraded land by bringing nutrients up from deep down and cover the earth, beginning the process of breaking up compacted dirt and allowing water to penetrate hard pans. One example of such a 'weed' often seen in Britain is bracken. Weeds are followed by pioneer species, these are often leguminous shrubs. In Britain bracken is often followed by gorse, broom and brambles. Pioneer trees are the next stage in regeneration. In Britain, these are often birch, willow, alder. These will often grow within the pioneer species, protected from grazing by thorns and dense undergrowth and gaining from the soil improvements made by leguminous species. Pioneer trees usually give way to mature ecosystems, often with the pioneer trees as edge plants or an understory layer. This could be seen as somewhat idealistic ecology, and it is not suggested that this pattern of events would always occur on degraded land. This is more a general pattern with which it is possible to work. Thus, an easy way of re-afforesting an eroded and

degraded hillside is to allow weeds to grow, seed the area with native shrubs and leguminous plants and allow the land to heal itself. It is possible to speed up this process by planting some pioneer trees and desired species (such as nut, timber and fruit trees) into the pioneer shrubs.

- III. A few developed edges can act as the site for further evolution. For example, wind breaks and fences act as nets and filters to trap nutrients which encourage plant growth. It is possible to set up trigger elements which will allow a process of regeneration to occur, such as placing bird posts on regenerating land. Birds will perch on the posts, bringing manure as fertilizer and bringing seeds of local plants in their manure. This can begin a process of regeneration without much effort, and has been used on many developing permaculture sites.
- IV. It is important to start from healthy areas and move into unhealthy areas. This reduces the amount of work required to establish systems, as well as increasing the likelihood of survival of plants. There may be small pockets or edges or relatively healthy wildlife on the site to act as a pool of information and resources. It is also a good time to learn to work with the flow. It is possible to make some tentative moves during the first year, trying local species, collected from the edges and local natural areas, planting at the edges. Plant upstream, uphill, upwind, and plants will continue their own colonization. Some plants will be successful and the process of regeneration and evolution can inform further design decisions.



[Back to the list of illustrations](#)

- V. Set up a nursery for native and useful plants and trees for regeneration. This can be seen as a trigger element for further change. It is important to try to use locally adapted plant material. Setting up a nursery has many benefits. It enables regeneration work to begin quickly and with less financial investment, it sets up a potential income source, as well as a genetic resource for increasing permaculture work in the locality. A nursery also allows us to gain some control over the propagation of plants and seeds and to reverse the current trend towards corporate control over genetic resources, with concurrent eroding of local autonomy and genetic diversity.
- VI. Whilst planning the design of the site, learn how to use what is already happening, increase the information base

about the site. Many 'weeds' are edible, you may find some surprising resources which suggests future directions, including potential medicinal plants, craft or construction products, as well as unusual food potential. Learn from and regenerate the wilderness area.

[Back to the table of contents](#)

5.0 Application of natural patterns to design

5.1 Implicate wholeness and patterns of change

In explaining David Bohm's theory of implicate wholeness, Lyall Watson uses the analogy of a hologram, where the whole is contained in its parts and each part contains the whole. (Watson, 1991: 41). This concept can effect how we feel about our actions in the world. It is common to see progress as an action played out in linear time, with each action having an incremental, cumulative effect on the whole. Thus any one action by a person will not make a big difference to the whole, it will merely pile up on the accumulation of actions of other people and will have a proportional effect. In contrast, an idea of implicate wholeness suggests that any action could have effects on the whole, like ripples moving outwards in a pond. Thus, the information encoded in any one design (such as for a farm) can affect the information contained in the whole system of which it is a part (such as the small town near the farm).

The point of interaction between a system in one organizational and energetic state and another is known as a bifurcation. "As you approach the boundary and cross it, you suddenly get a phase change...and it changes very quickly, pushed by a slight change in conditions" (Lewin 1993: 17). This change of phase states, common in physics, can be seen as analogous to shifts in other systems, including those of social complexity. This concept is similar to those of 'threshold effect' and 'trigger elements'.

Lewin suggests that the point of change from one state to another, what he calls the 'edge of chaos', can be a domain of creativity and an area where "information gets its foot in the door in the physical world, where it gets the upper hand over energy"(Lewin 1993: 51).

The edge of chaos is a non-linear world, where a small perturbation no longer necessarily produces a small effect, but where simple changes can produce complex patterns and there is a "possibility that information processing can become an important part of the dynamics of the system" (Lewin 1993: 51). Permaculture design could be seen to be acting at the edge of chaos, at the edge of a change between systems. Information is echoed throughout the system. It is implicit in each of our actions. Small changes can act as the trigger element to restructure system.

Bioregional data banks and small education centres and workshops can become effective centres for change and education for the future. The greater the information content embedded in any part of the design, the greater the potential for change. Once an information-rich centre has been established, patterns will begin to repeat and spread.

[Back to the table of contents](#)

5.2 Spatial understanding

It is important to understand patterns in terms of space, as the physical structure around us effects the way in which we behave. It is through the spatial structuring of our environment that we are able to obtain our needs, to travel, to work and to interact with other people and with nature. Spatial structuring effects our use of energy, our ability to recycle and the amount to which our activities are polluting or environmentally degrading. It effects the way in which our activities have an impact on soils, water and forest reserves. Our interaction with natural cycles, such as the hydrological cycle and the growing of plants, is affected by the way in which the environment informs our behaviour.

It is not very common to question what effect spatial configurations and structuring have on our behaviour, emotions and reactions to nature. I would suggest, however, that this is a very important mode of enquiry, partly because it is so all pervasive in the way in which we are able to respond to the natural world. The way in which our space is organized can also effect the way in which we spend, and even perceive, time. If people spend a large proportion of their days in buildings which show no response to external stimuli, or the passage of time, they will feel disconnected from the rhythms and pulses which structure the natural world, such as the rhythm of seasons, days and nights and changes over time.

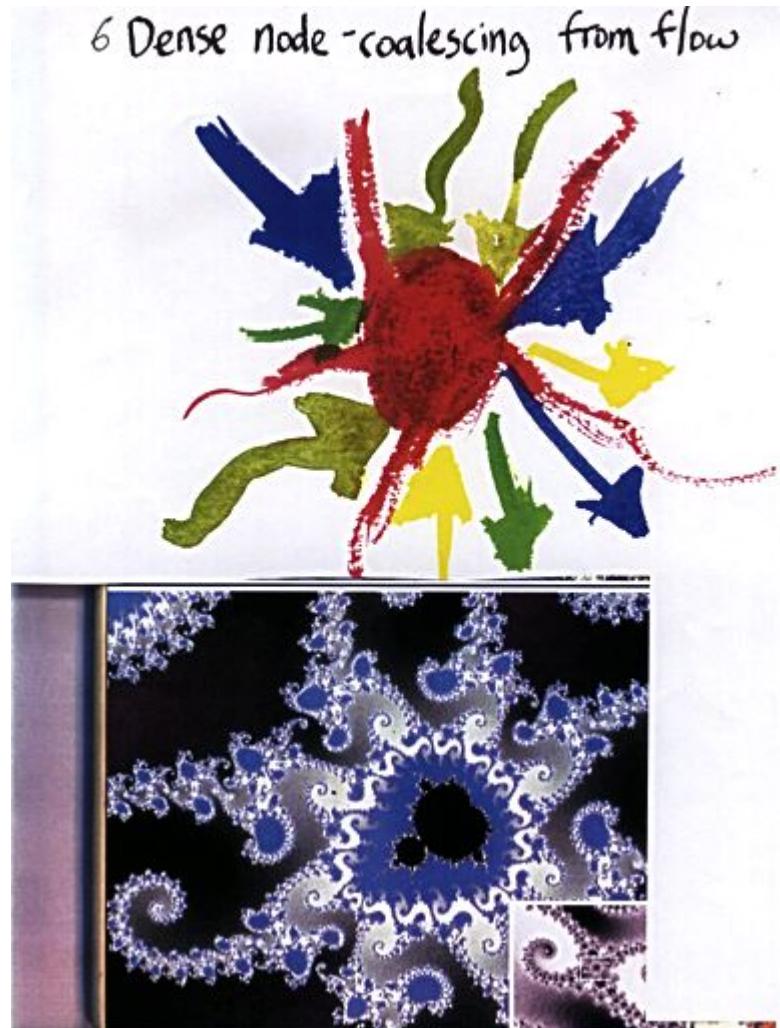
The extent to which our environment is built of inflexible, unresponsive units with little interaction with natural systems, determines the extent to which systems are allowed to evolve and respond to the environment. It is physically impossible to gain any sense of self-reliance in terms of food, shelter, fibre, timber and food if there is no connection between the space in which one is living and soil, plants and ways of growing food.

The questioning of space and form can lead into new ideas about the structure of human habitations, buildings, and the interface between people and land. It is possible to apply insights from an understanding of patterns in nature and the forms of fractals to planning of space. This can provide many insights into alternative ways of structuring the space we live in, which opens up many possibilities for a different way of living, with a corresponding effect on ideas of quality of life.

[Back to the table of contents](#)

5.3 Nodes

The analogy of a node from fractal geometry comes from the dense centres of activity which can be seen to be coalescing from flow in dynamic systems. In design terms, a node is a centre of human activity, the physical form as a coalescing of the activities of people's lives and the flows of materials and energies which go to structure our physical environment.



[Back to the list of illustrations](#)

Thinking about these nodes, or centres of dense activity within flows, can give many ideas for a restructuring of space and the way this effects flows of energy and resources.

In sustainable design, each node would have the functions of human settlement, production of goods, housing and material needs, energy and food, craft industries and equipment and facilities for processing information and education embedded in its structure. There should be a maximum of recycling of materials and energy on the site, with most raw materials being produced from ambient solar energy, or grown, and each function being embedded through cycles into an ecosystem. Water and waste recycling systems and rainwater collection are important to maximize productivity and self-reliance. The location of these functions together in one node is important for the sharing of resources, structures and information, the conservation of energy and the efficient cycling of materials.

Nodes are dense centres of activity. They are physically compact in order to increase social interaction and internal

cycling of energy and materials. Density of form allows a reduction of energy costs due to transportation and a reduction of land taken for human use. This allows more land to be returned to wildlife.

"The growth of decentralization parallels the decline of industry" (Naisbitt 1984: 98). I would suggest that this is the decline of large, brittle industrial structures. What can be built instead, are small, decentralised units. An example of flexible, decentralised manufacturing units can be found in Italy, Denmark and New York City. "Tiny employee- and family-owned businesses band together to produce major products in the metal-working, machinery, electrical, transportation and farming industries" (Friedman and Hatch in Fiske 1988: 3) These linked businesses allow for a high degree of creative adaptation and show potential for an increased amount of craft work and job satisfaction in cities. "It has been suggested that a city with multiple self-contained centers uses 1/17 of the energy of a uniform spread settlement and 1/6 of the energy of a single centered city."(Rappaport, Amos, in Fiske 1988: 3).

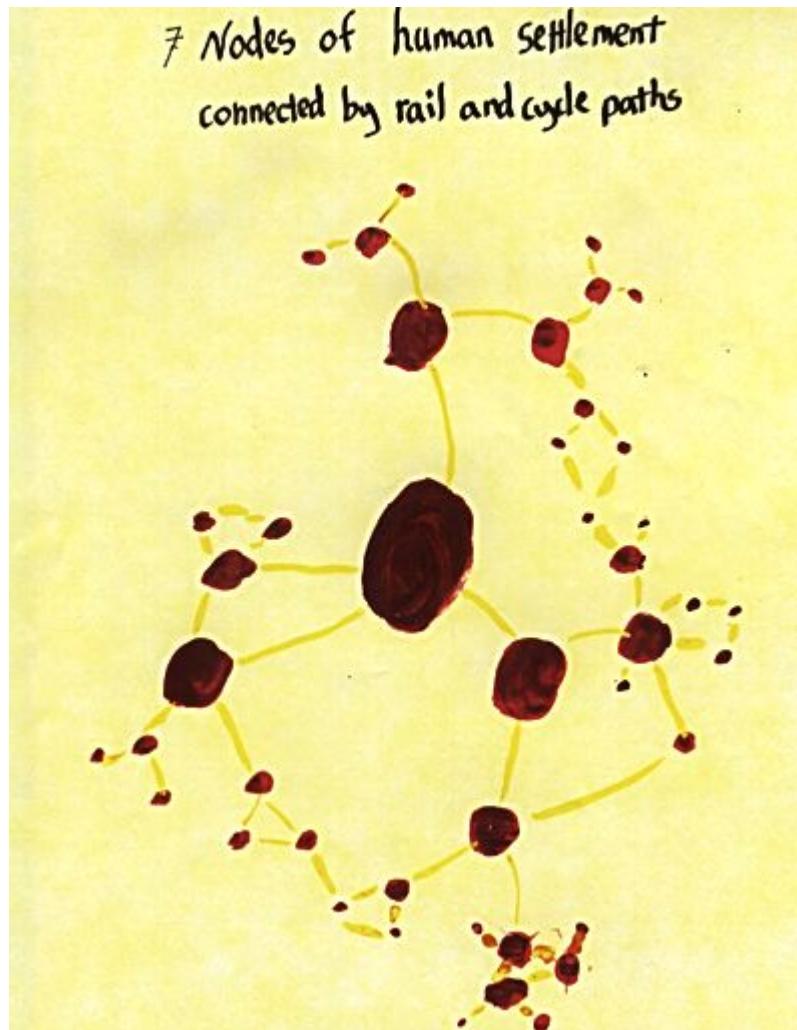
In permaculture systems, there is a need for a light footed, flexible design, as this allows for evolution over time. Design should be responsive to and growing from conditions of place, such as renewable energy sources, building materials, food production systems and native tree species. This is an alternative to creating manufacturing units which are huge, cost a lot and have a high embodied energy in both the buildings and in the machinery. In order to be able to adapt to changing conditions, we need to create production units which are simple and cheap to build and which are made from renewable and recycled materials. An in-built flexibility allows systems to optimize local resources and gives a greater work security for local people, due to a less brittle structure and an increased ability to adapt.

In this language of nodes, it is also important to remember the importance of levels of scale. In communities as well as in manufacturing processes, there are certain levels of scale at which functions are most efficient. One of the most important features of designing within ecological understanding is an appreciation of natural limits. These limits apply to consumption and to the way in which energy and resources are used. Ivan Illich suggests that in industrial-consumer society, "inherited myths have ceased to provide limits for action. If the species is to survive the loss of its traditional myths, it must learn to cope rationally and politically with its envious, greedy and lazy dreams." (Illich 1976 :263). Evolution of an ecosystem provides a model for how we could appreciate limits. As an ecosystem develops, a period of rapid growth is replaced by self control and feed back mechanisms. Permaculture does not envision a frenetic drive for ever more production and consumption, which as Illich says, "has made technical answers to mad dreams seem rational" (Illich 1976 :263). When following nature, one has a tangible sense of limits inherent in working with natural processes.

Efficient levels of scale are determined by the ecological carrying capacity of an area (ability to produce resources and absorb wastes) and the provision of renewable energy. This is not the same idea of economies of scale as proposed by industrial economics, but rather an understanding of the levels of scale appropriate to an efficient functioning of ecosystems and human communities. We have set up very brittle structures using the false economy of too much fossil fuel energy. People learned to rely on these structures, such as the company and large industries, to provide them with a job so they could buy what they needed. As these large structures crumble, we will need small centres which encourage self reliance and creativity.

Creative design does not see working within natural limits and feedback mechanisms as a problem, but rather responds to the challenge to create beautiful, elegant solutions. A hallmark of creativity is to respond to real needs and work within some limits. Boundless technological optimism is no longer an option, and permaculture offers a way of working within this realization without resorting to drudgery and hardship, while providing an equitable and high quality of life.

Nodes are decentralised in terms of space, government and control. To hold power in a centralised state takes a lot of energy and requires a high level of structures of control. This can be seen in the amount of money and control required to maintain a central government over a country. Efficient public transport would assist the decentralizing process. It is envisioned that each node in an area would be connected by an efficient light rail and cycle path link, such that it is easy to move from rural areas to cities, and each large centre of population would be linked to small villages and wild areas.



[Back to the list of illustrations](#)

[Back to the table of contents](#)

5.4 A sense of belonging

One of the most important ideas in design for human settlements is the need for a sense of belonging. Susan Sontag speaks of a "discontent about and obsessive preoccupation with the isolated self and its never altogether satisfactory "relationships", which bears the unmistakable stamp of our consumer culture." (Sontag 1977 :51). Sustainable design should try to understand the trends which help create this sense of isolation and disconnection and work to develop a sense of roots and of co-operation.

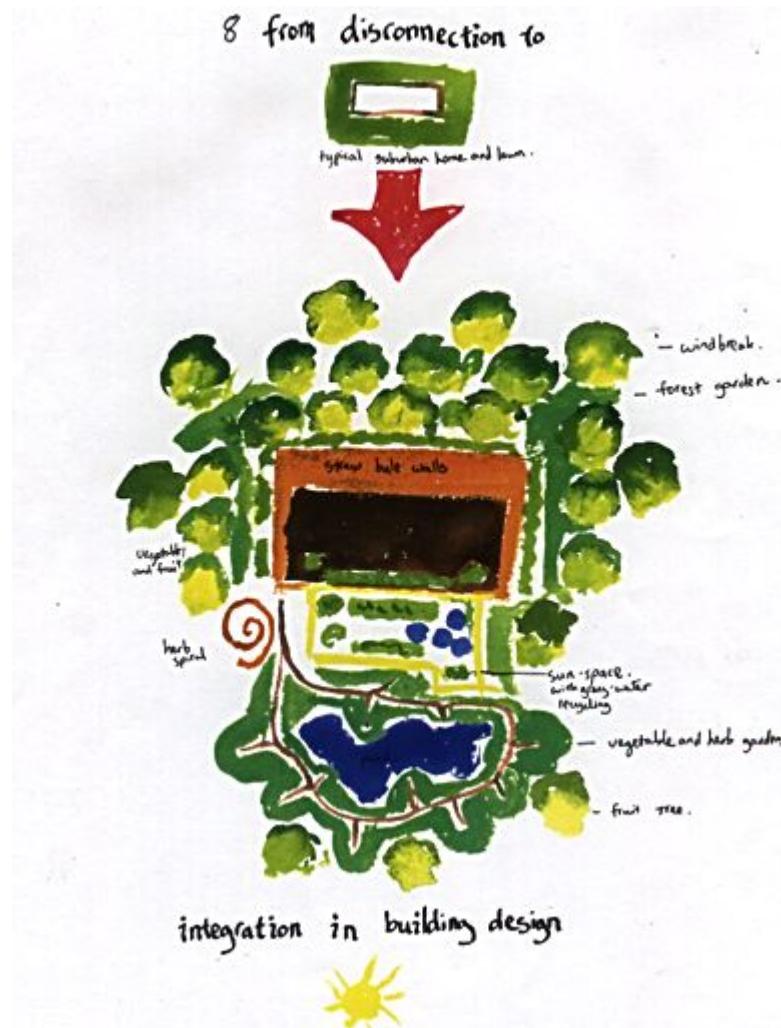
Developments which are huge, ugly and impersonal do not encourage people to feel that they belong to a cohesive community. Planning which does not include common land, places for people to gather and facilities for people to use does not encourage social interaction. If people do not come into contact with plants and natural processes, they will not feel that they belong to the land and the area. A deep sense of rootedness and belonging to place is essential in order to develop a working ethic of people caring for the land. This sense of connection is important at many levels of scale from that of the building to urban design to regional planning. Architecture should reflect regional differences, people need to feel they belong to identifiable places.

[Back to the table of contents](#)

5.5 From disconnection to integration in building design

"Northern civilizations have moved, in stages, towards encasing themselves in glass and metal structures" (Lawlor, 1991: 129-130)

Green architecture has been developed as part of sustainable design, in response to increasingly toxic and artificial built environments and alienating architecture. We spend a good proportion of our time in buildings and this is a central determining factor on our health and mental state. Buildings and the way they affect the landscape are of central importance in design. Building design determines a lot about how energy is spent and how materials and waste streams are used. They can be designed to facilitate a conversion of resources to pollution in a linear flow; or as cycling entities, producing their own energy, water and food requirements and cycling their wastes. In green design, buildings can almost be seen as organismic or systemic.



[Back to the list of illustrations](#)

A sense of connection to the land can be brought into building design. There is a move from distinctly compartmentalized indoors and outdoors to a crenellation of space, an elaboration of the edge at which the outdoors is brought inside. Plants blur the difference between indoors and out and extensive plantings help to control climate within a house, through shading, transpiring and insulating. Large greenhouses and sunspaces attached to the south of buildings allow passive solar heating and the growing of food and increase indoor-outdoor space. Gray water recycling systems within the greenhouses act as heat stores and bring water into the form of the house.

9 Ambiguity - Indoor-Outdoor Connections



[Back to the list of illustrations](#)

Walls can act as huge heat stores for passive solar heating. They can be built of natural materials such as earth, straw, stone, woven, coppiced wood. Floors can be built of tamped earth, wood, cork, stone, woven materials, and fibres. There is a strong sense of texture, tactile sensuality and of natural colour. Natural elements are woven into the construction and brought into the house at every level.

[Back to the table of contents](#)

5.6 urban planning

Inherent in the idea of developing nodes of sustainable activity is a rethinking of the nature of urban planning and the way in which we organize human settlements. Permaculture is not only concerned with human activity, but it is important to change the way in which human beings obtain their needs, as it is this which continues to degrade the environment at a fast rate. In permaculture, there is an important idea of starting with what is already there, and working with the current resources and structures. It is very wasteful of energy to try to impose an entirely new structure on a site. Rethinking human settlements offers a powerful tool for change, particularly as there are many ways to change the structures which are already there in order to move them towards sustainability and regeneration of natural resources and wildlife.

Permaculture is not inherently anti-city. Cities are important in cultures. Just as a diversity in land use is encouraged, a diversity in human lifestyles is important. What is needed is a new paradigm for urban development and regeneration.

[Back to the table of contents](#)

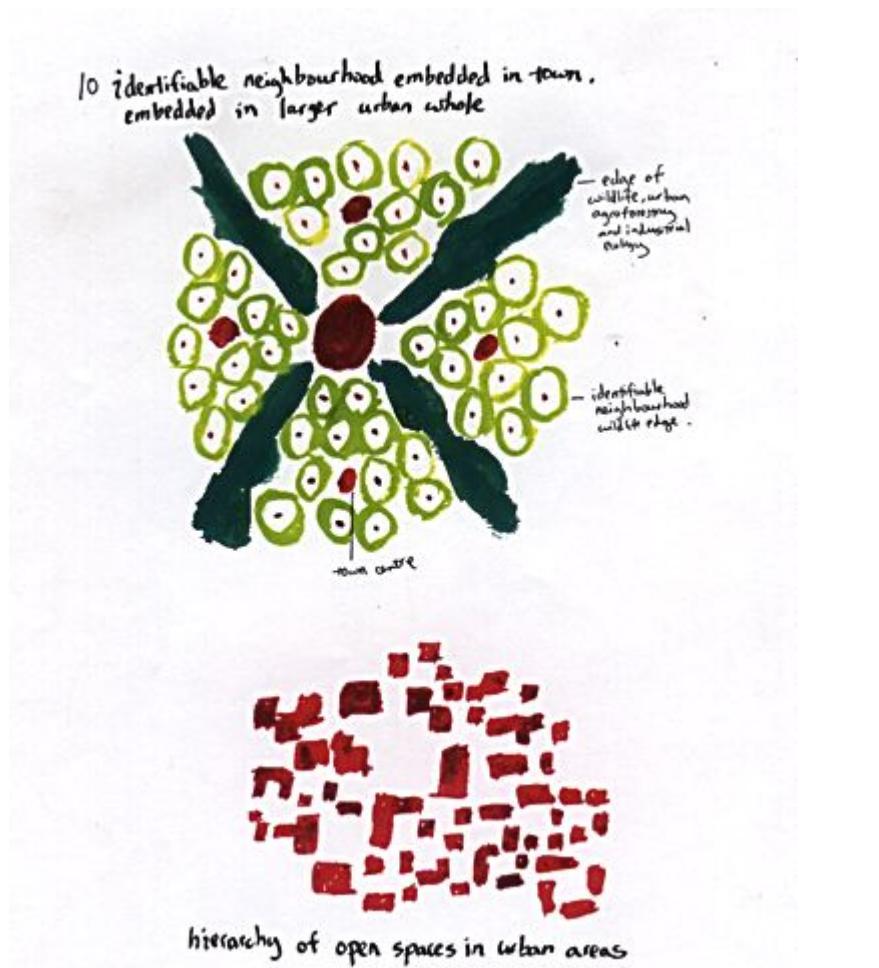
5.7 Levels of scale and density

Larger urban units should be made up of collections of smaller wholes. The smallest unit, or 'identifiable neighbourhood',

would be made up of approximately 500 house-holds. It is very important to have small units with discernible identities and centres in order to foster a sense of community and cooperation. These smaller, village-like structures allow areas to develop with different characters and styles and encourage a sense of community within the small unit, as it is easy to get to know people. It is relatively easy to have small scale organisations and governing structures in these small units, as information is easily shared.

In planning a town, it is reckoned that the maximum distance which is reasonable to expect people to walk to get to amenities is about half a mile. This gives a small town an area of about half a square mile, with a population of about 5,000 to 8,000 people, occupying about 23 acres. A small town would be made up of around 10 'identifiable neighbourhoods'.

A city would comprise approximately 4 of these medium sized town units, each relatively self contained, but integrated in to a larger whole around a city centre. A city would have a population of approximately 20 000. This is the size at which cities seem to function the best, large enough to support all of the specialized and cultural functions which make a city interesting, but not so big as to be an anonymous conglomeration of people.



[Back to the list of illustrations](#)

This was the structure found in Medieval cities, which reached populations of around 20,000.

"This commune, a city, not a state, was divided into four quarters of five to seven sectors radiating from a centre, each quarter or sector roughly corresponding to a trade or profession, each with inhabitants of different positions and occupations". (Kropotkin, 1902: 148).

Each quarter would be made up of approximately 10 village-type units, embedded in the larger whole.

A development should include many communal outdoor areas at different levels of scale, from large parks and forest gardens to small communal courtyards between houses. Small outdoor spaces are often neglected in an overall plan, but they are essential to encourage social interaction. Nooks and crannies, wall benches and slight widenings on a path add a sense of interest to the landscape. They create a sense of intimacy and are places where people are likely to meet by chance and linger. Small plazas and squares, especially when ringed by shops, cafes and restaurants, bring life to a place by providing areas for people to meet and interact.

There is a discernible level of scale at which communities function well. It is important to maintain a sense of hierarchies of scale within larger urban units, so that areas develop cohesive community structures and are able to develop their own characters. Each 'identifiable neighbourhood' in a city could have its own speciality or flavour, perhaps theatre, restaurants or art galleries. Each 'village' could have distinctive architecture. It is possible to start with existing urban areas and identify areas to begin developing these village-like structures, developing identifiably different regions, creating edges between areas and an increasing in the density of homogeneous settlements around identifiable centres. This can help to reduce a sense of isolation and anonymity which is often apparent in modern cities.

It is important to think in terms of density in planning. Dense housing arrangements means no-one lives very far away from services and shops, people live close together and the population is large enough to support a lot of services. A dense development pattern is one of the more essential ingredients for creating car-free or minimal-car-use settlement, as it becomes feasible to walk and cycle as a means of getting around.

Density in housing has the advantage of releasing open space for common ground, parks, community gardens and forests and wildlife areas as the housing area is reduced and clustered together. This contrasts to the development of suburbs, where houses are spread evenly over an area and there is no discernible centre and few open areas of land.

It is important to encourage a re-population of rural areas, but not in a spread-out form, such as the homogeneous pattern of development in the suburbs. This neither enhances the character of the land, nor allows for a sense of community and co-operation to develop. A unit of about 500 households (as in the identifiable neighbourhood in a city) would be ideal for a village development in a rural area. Rural villages should be linked to larger centres of population through public transport and cycle paths. This helps to encourage the flow of ideas and prevent feelings of isolation and stagnation.

It would be envisioned that a variety of housing structures, with varying degrees of communal facilities would be made available. It is time to move away from the inflexible idea of building a lot of private houses for married couples with 2.2 children, and build housing stock which is responsive to changing societal structures and needs. The housing stock can be designed with some in-built flexibility to allow for variations in household structures. Flexibility can be achieved partly through the use of biodegradable materials such as bamboo and coppiced wood, which are light and relatively easy to alter. This would help to reduce redundancy in housing stock and would help maximize potential uses of buildings.

The development of co-housing is one possible way to increase flexibility in community structures. Co-housing units are formed of about 30 households sharing a communal space, which can range from a communal kitchen and dining area, to a building with day-care facilities, craft workshops and communal gardens. Members of the co-housing usually share meals, with reduced costs and time spent preparing food. More facilities and options can be made available to the community than would be possible in single family houses. A co-housing development could hold 'teenage and granny flats' in common, which could be used by the members of the group as the requirements of the individual houses changes. Thus any one family does not need to build a new flat as the need arises and there is a greater flexibility in use of buildings. A village or identifiable neighbourhood could contain up to 15 co-housing units.

[Back to the table of contents](#)

5.8 Fractal branching: from disconnection to integration

In spatial planning we can make a choice between placing different elements far apart and emphasizing separate zones of business, housing, wild life parks or developing an integration of different functions in the same area. Maintenance of rigid boundaries between these areas is often encoded in law, such as the zoning regulations which have helped to create the suburbs in the U.S.A.

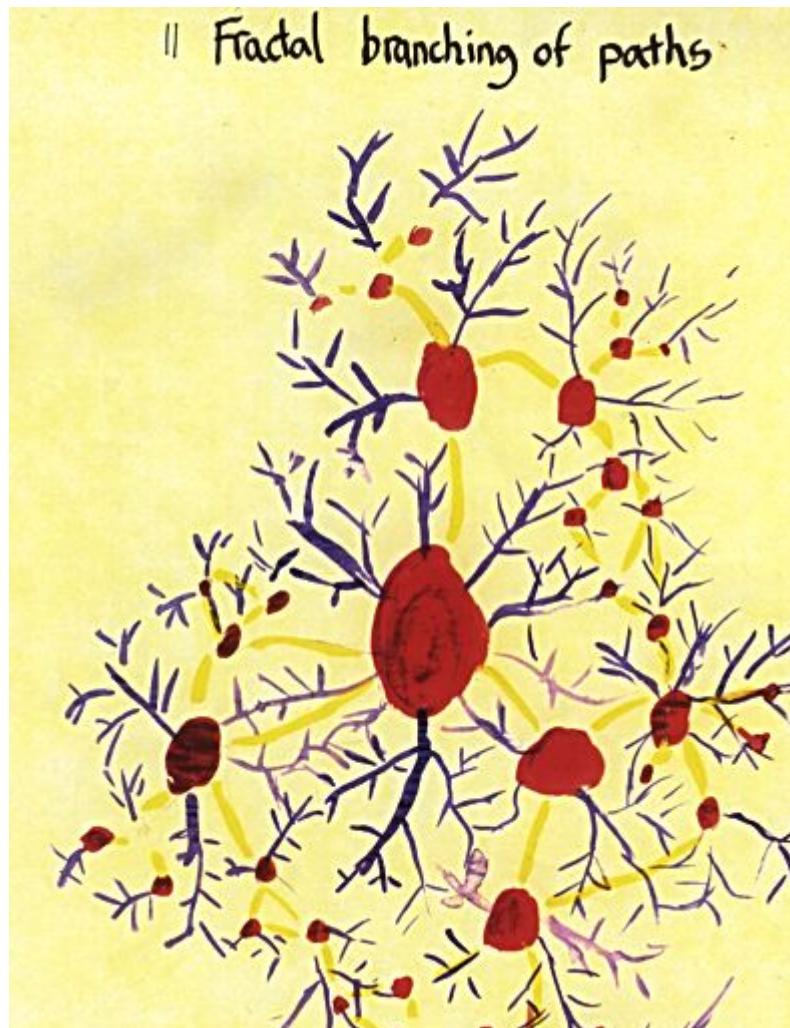
Spatial separation of functions encourages the use of motor cars and increases distances travelled. Planning for cars in modern transport is one of the most alienating and energy wasteful systems we have set up in industrial-consumer society. Driving a car is an activity which is sealed off from interaction with other people and with the land, partly through the nature of the car, which is a box of steel and rubber which has very few connections to the space around it. The speed at which cars travel can have advantages, but as a day to day means of getting about, such speeds can be divisive of communities due to danger and noise.

Time, energy and speed are related in the way in which we move about. Modern transport systems, especially the car, have tended to encourage speed as a virtue in itself. We can travel faster, farther. This speed, however, can be very destructive of landscape and community, at the same time as encouraging a sense of harriedness and transience.

In contrast to a design for speed, it is possible to design spaces in order to encourage people to linger, to spend time in a place, to walk and to meet other people. This type of design places a higher emphasis on the importance of time being well spent and lower emphasis on the necessity of saving time. Design decisions depend on whether or not time is considered to be a commodity to be saved or a quality with many variables. (Whitelegg 1993).

An alternative to planning for cars and separation of different functions is an emphasis on connections, short distances and accessibility. One of the advantages of an integrated approach to urban planning, where housing, retail, employment, agriculture and production are located close together, is that walking and cycling as a means of transport become more feasible. Paths are very important in this type of planning, where the experience of moving is as important as the experience of arriving at a place. Walking and cycling increase contact between people. "The simple social intercourse created when people rub shoulders in public is one of the most essential kinds of social "glue" in society." (Alexander, 1977: 489). An area designed to be safe and pleasant for walking and cycling would have a very different physical form to an area designed around cars. Tree-lined paths would be developed for pleasant walking and cycling. Less space would be given to tarmac for roads and car parking. It would be possible to see a greater integration of work, home life and education and less time spent commuting.

Walking can help to heal some of the fragmentation between people and nature. Networks of paths can be seen as weaving a web of connections into the land. Fractal paths weave together nodes of human activity with the land which supplies them with their needs and with natural areas, such as forests and wetlands.



[Back to the list of illustrations](#)

I think these DesignWays are very important. They are ways of connecting the individual body to the land and of creating social and ecological connections within a design. DesignWays facilitate the flow of people, ideas, information, energy

and materials. Unfortunately, this has been taken to extremes in the Western cult of the Motorway. It is not the facilitation of massive flows of goods which I am talking about, but rather an intimate connection in a place which facilitates walking and cycling.

The idea of an interconnected, branched network of paths over the land is also important in the idea of food-foraging. In permaculture, a variety of food crops are grown in polycultural systems such as forest gardens, and people are intimately connected with the growing and gathering process. This contrasts with crops which are harvested and brought to the consumer. A network of paths which brings people into contact with their food source is important.

As these polycultural systems will be new to people and will require a high degree of biological literacy, it is important to learn how to encode information about unusual, unfamiliar types of food in a way which is easy for people to understand and learn. One idea is to have educational trails rather like the nature trails in American National Parks, where there are marked posts along the way and informative leaflets which follow the trail. Information such as harvesting times, uses of crops (medicinal, culinary, and craft products), ways of preparing, ways of propagating and spreading the plant and sources of seed or root stock are all vital. It would also be interesting to include any local legends and indigenous or historical uses concerning the plant.

[Back to the table of contents](#)

5.9 Crenellating the edge, urban rural integration

"The greatest and most fatal error of most cities was to base their wealth upon commerce and industry to the neglect of agriculture." (Kropotkin, 1902: 177).

In our language, there appears to be a dichotomy between the words rural and urban. The two words are set up as diametrically opposed to each other, two different types of space, and by definition allowing different types of activity. In this paper, I am using these words as working terms, not as sacrosanct ideas which are different. The aim is to blur the distinction between the ideas, but in order to talk about doing this, it is important to have words with which to work.

It is important to bring people into contact with the land. Part of the fragmentation and dis-connectedness we see in industrial-consumer society comes from the fact that people buy food with no idea where it has come from, or how it has been grown. One prime directive of permaculture is that food should be grown where it is required and where it will be eaten. Food is not received packed in plastic, there is instead a continuity between people and the growing cycle. People are involved in the soil and in growing their own food. This is very important in cities as well as in rural areas.

An anecdote was related to me during my first permaculture course of an area of good farm-land which was converted to a housing development during the 'Inter War Years'. The agricultural productivity of this land actually went up after houses had been placed on it, due to the inhabitants gardening to grow their own food. Gardening is the most productive form of agriculture. An important permaculture principle is that one should be able to see the vegetable garden from the kitchen window. It is important for the health of humans to be in intimate contact with the growing cycle. If the vegetable garden is right by the kitchen door, the people in the house will be able to make full use of the food grown there with very little effort and the vegetable garden will flourish due to the increased attention it receives.

The ideal in permaculture is to aim for a society in which most food is grown where it is needed, gardening is very important and no centre of human habitation would not grow at least some of its food. This is located at the edge of each node of each building and community, and helps to integrate these into the natural environment. There are many ways of gardening which fit into local ecosystems and natural processes. These range from gardening to encourage wildlife and create natural habitats, to growing native edible wild foods, to growing plants in polycultures, with flowers, vegetables, herbs, fruit trees and bushes forming an integral unit.

There are huge potential growing spaces in cities and towns. Many roofs, walls, trellises, balconies can be used for growing food, parks can be planted with productive trees and there is much waste land. Good urban design will condense areas of settlements, with a corresponding increase in open areas which makes it possible to introduce more agriculture. Sewage from the urban population could become a valuable resource, enabling highly productive food farms to be developed within the city and at its edge. "According to the Environmental Protection Agency, US. sludge (if used as a fertilizer) ...has an equivalent value of \$1 billion per year.(Fiske 1988: 2-3).

Growing food in urban areas also has important implications for energy consumption. Transportation of agricultural produce from its source to where it is consumed accounts for 10% of agricultural energy consumption, with the average food product in the U.S.A. travelling 1,300 miles before being eaten. (Fiske November 1988: 1).

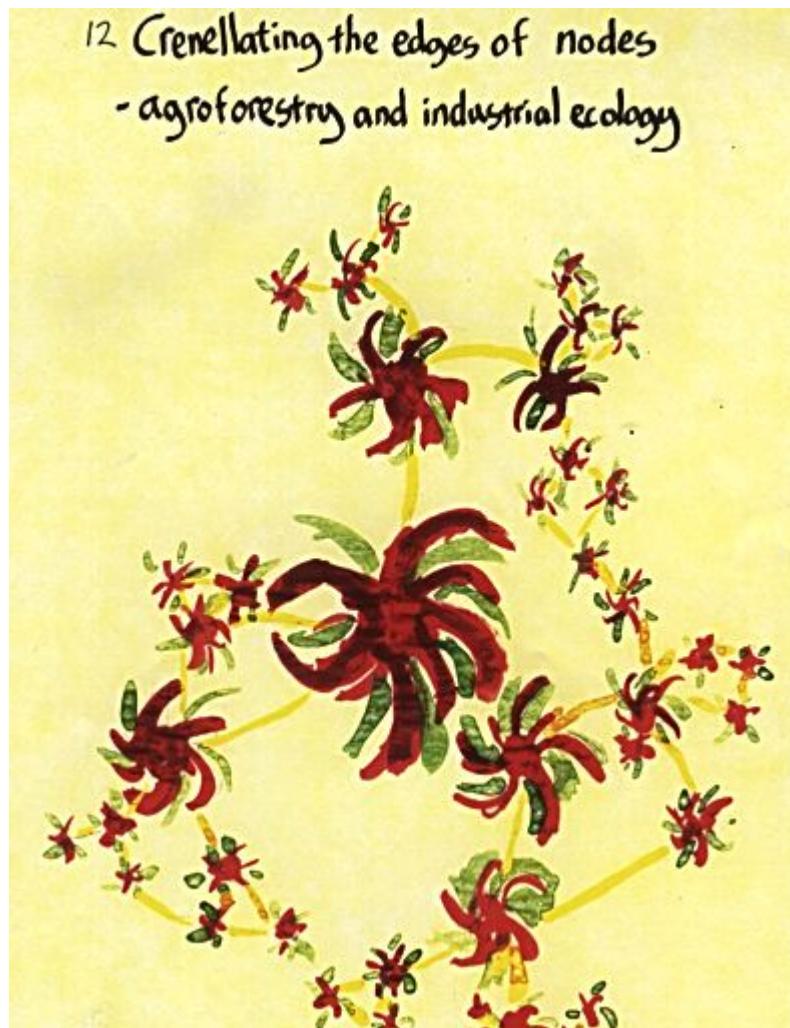
The suburbs are also potentially highly productive areas. In the U.S.A., lawns consume more chemicals and energy than what is traditionally considered to be agriculture. These green anachronisms offer a great potential for productive,

beautiful forests and landscapes The suburbs could be full of wildlife and colour and produce fresh, organic produce.

There is potential for increasing urban -rural links. This can be done through encouraging city-farm links, where urban people are connected to a specific farm, they are able to go and work on the farm at times and buy produce directly from the farmer. This has many benefits for both producer and consumer. "Consumers receive fresh, organic food on a regular and affordable basis whilst the grower has a reliable market which isn't subject to the strict requirements of the supermarket or competition with imported produce" (Pullen, 1992: 3). There is also a reduction in transportation and costly packaging of food, an encouragement towards local production and an increased involvement of urban people in the food they eat and in the surrounding countryside.

This idea of urban-rural integration is related to space and spatial planning. What is envisioned is an interlock between rural and urban, a deep knitting together of both in a way which draws connections on many levels. This is both structural and process orientated, in terms of land use functions and methods of production, and in spatial terms. Agriculture and agro-forestry occur at the edges of nodes of human activity and are seen as the interface between humans and wildlife systems. Fingers of human activity extend into the natural areas. Rural fingers are brought into urban areas, pockets of wildlife are developed within urban areas and connected by wildlife corridors. A web of natural and food producing areas is developed throughout each urban area.

It is certain that our activities will affect the land, however, it is possible for us to learn how to mould space in a way which respects its structure and history, as opposed to imposing our own structure with no regard for the place and the continued health of its ecosystems. Agriculture should be modelled on the natural systems of an area. As Berry has said, "if the farm is to last and to stay in health, the wilderness must survive within the farm." (Berry 1991: 56). This becomes possible due to wild life webs within the farm and the farm having a crenellated interface with the wilderness areas. A river carves the land, and is affected by the land through which it flows. We can learn from the branched structure of the river. Inspiration for this structural form can be seen in the spiralling fingers leading out from centres in fractals. These spirals embed one form into the whole, increasing the edge between systems and causing a deep interlock at many levels. An elaboration of the edge increases potential for growth and creativity.



[Back to the list of illustrations](#)

[Back to the table of contents](#)

5.91 webs of wildlife

One of the main aims of permaculture design is to regenerate natural areas and reduce the land required by humans so that we can take a more appropriate role within natural processes. This stems from a realization of our dependence on natural systems. The aim is for each settlement to be surrounded by a thick boundary of forest and trees, with pools of wild areas within each town or housing area. Defining and mapping these webs gives and insight into which areas to develop where to concentrate building, how to link habitat areas and where to develop reafforestation and stream regeneration projects.

An understanding of edge effect works in design through the development of nets and filters, which trap nutrients and begin a process of regeneration. In England, we have tended to think of hedgerows as having been planted by humans. Hedges can develop without being planted, given a net of fencing which traps nutrients and encourages birds to roost and drop seeds with their faeces.

"North Americans lacked this (hedge planting) tradition: settlers fenced their fields with wood or wire. Yet the United States now has many more miles of hedge than Great Britain. ..Tree saplings sprang up alongside fences and eventually replaced them.." (Rackham 1986: 182).

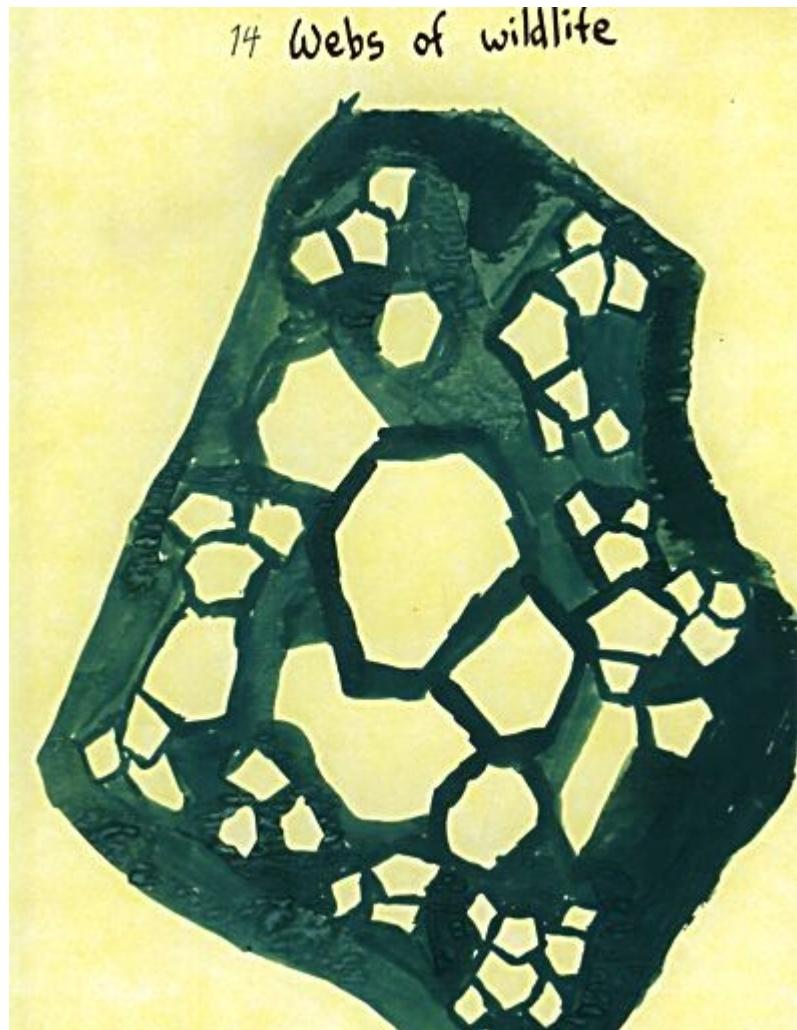
Networks of waterways, windbreaks woodlands and hedges act as wildlife corridors and help to mark the character and beauty of land. The edge effect can drive design as a net and point of evolution. The structure of these edges should be in the form of a web connecting important habitat areas, wooded areas and waterways .



[Back to the list of illustrations](#)

The designer can: "chart patterns of urban creek [or stream] sheds and open space, link them together, and use the emerging green web to define new villages." (Aberley 1993: 5). Existing natural areas offer their own impetus for change. Regeneration can spread from a healthy core, and if left alone, hedges and wildlife areas will spread and change the character of an area.

Given the nature of regeneration, it isn't necessary for humans to try to implement a full plan of restoration of land all at once. For an integrated plan of regeneration of natural areas to work, however, there is a need to identify objectives and areas where work could be done to greatest effect. A designer could start by mapping existing areas of wildlife, forest cover and stream and river ways, then identifying potential areas for increasing natural habitat, such as parks, waste areas, car parks, school- yards and unproductive agricultural and degraded land. A map which shows a potential web of wildlife corridors will begin to emerge.



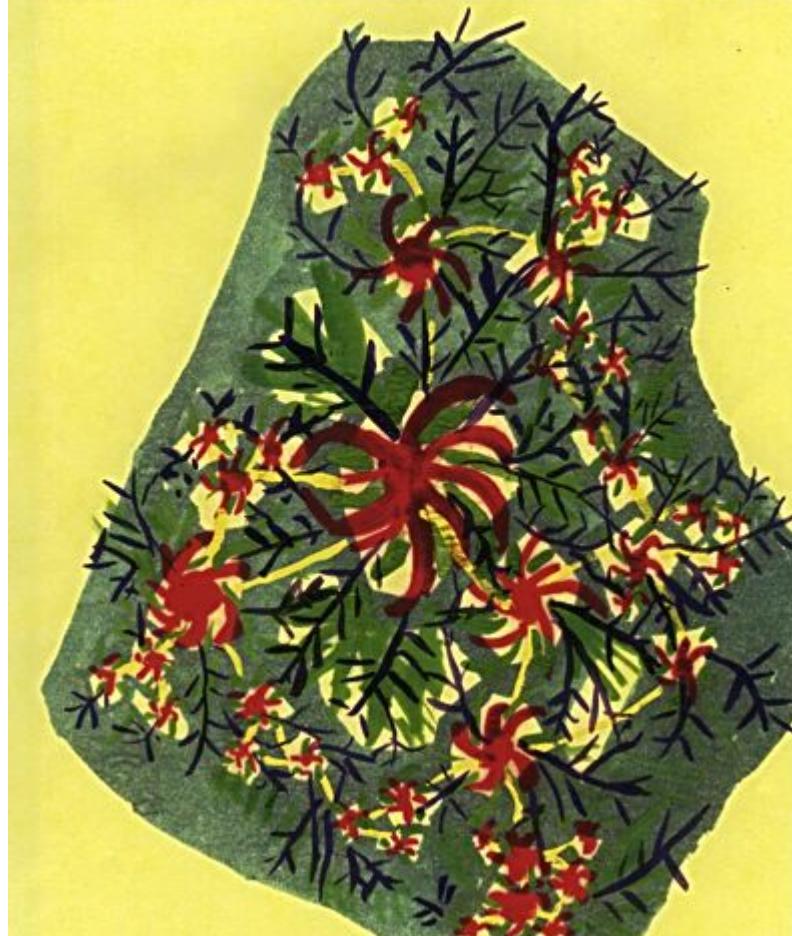
[Back to the list of illustrations](#)

[Back to the table of contents](#)

5.92 Pattern of sustainability, an example

The pattern of sustainability which has been built up in the last section can be applied to many different circumstances, from an individual building to a city, to rural areas, to new developments, to suburbs and in regional planning. It is possible to use these ideas to shift settlements towards sustainability, and both plan new 'perfect' ecological communities, and apply the ideas to places which have already been built.

15 A pattern of sustainability



[Back to the list of illustrations](#)

In cities, this would involve looking for opportunities for increasing wildlife habitats, linking any existing open areas with wildlife corridors, developing urban gardening and city farms and extensive tree planting. It also involves increasing the density of areas around centres and stations of public transport, such that a discernible sense of community is allowed to develop and there is a greater sense of contrast in density and open space. It involves unearthing streams which have been buried in developments, looking for opportunities for integration in terms of energy planning, recycling waste streams and the development of ecological facilities to deal with sewage and wastes.

16 Detail of a Node and wildlife web



[Back to the list of illustrations](#)

In rural areas, this means developing communal facilities, stopping suburban sprawl and concentrating on developing village structures which are able to support a sense of community and many different types of activities. Increasing local food production and the growing of natural resources brings a sense of local self-reliance.

Applying a pattern of sustainability in suburbs would involve a similar process of increasing density of building space around centres and opening natural and food growing areas as in urban areas. A development of an ecological infrastructure and an increased level of integration between human activity and natural processes would help to define areas for condensing development.

Large community forests would be planted around all human habitations, facilities to recycle wastes and water would be installed and streams and rivers would be given an important role in defining the structure of urban areas.

[Back to the table of contents](#)

6.0 Patterns of production

Nodes of human activities will need to be supplied with food, timber, fuel, water, materials, household goods. This section is about what we eat, drink, wear and what materials we are surrounded by. This is the interface between human culture and natural systems. "Our technology is the practical aspect of our culture." (Berry 1991: 4). Methods of production are processes which shape space and provide sustenance, thus, they constitute a way of living within natural systems.

One possible critique of permaculture would question how it is that we can know we are following a reasonable land ethic, such as described by Leo Aldopold (1949), which suggests that our actions should not damage the integrity and beauty of natural systems. It isn't possible for us to live in a vacuum, and our daily lives do effect nature. As Oliver Rackham, a historian of the British countryside, points out, "The ordinary landscape of Britain has been made both by the

natural world and by human activities, interacting with each other over many centuries". (Rackham 1986: xiii). We tend to think of making changes as being potentially harmful. I would posit, however, that by not acting, we are still effecting the environment and using resources. We tend not to question the way in which we are living. I would suggest that by doing nothing to change the way in which we live, we are indeed making a conscious decision to act and to continue to degrade the resources upon which we depend.

Observation of nature would suggest the conversion of the linear flow of resources, from raw material to finished product to rubbish tip (the current model of industrial production), into a cyclical flow, where natural processes use the sun's energy to provide materials, and decomposers convert waste to food for the system. Inherent in this cyclical flow is a process of ecological regeneration, which involves the cleansing of water, the building of soil, increasing the health of plant communities and planting forests. In this process the resource base of an area is developed. The environment becomes less polluted. Ecosystems are restored to a state of dynamic health and resilience through the actions of producing what we need. Human communities could be revitalised in the process.

Permaculture is a process of empowering people to make a change in their life and to make them able to meet their basic needs, thereby reducing dependence on the industrial structure which makes up the current fabric of our lives. Ivan Illich suggests that such a dependence devalues our creative ability to provide for ourselves. "When more than a certain proportion of value is produced by the industrial mode, subsistence activities are paralyzed, equity declines and total satisfaction diminishes." (Illich 1976: 264).

[Back to the table of contents](#)

6.1 Value adding to resources and job creation

Self reliance and local production are made possible through an idea of intense value adding to raw materials in the area where they are produced, and would have many advantages for the community. One advantage of this would be a potential increase in quality of life, as good quality craft products, beautiful houses, unpolluted water and healthy organic food become the norm.

Jobs are created in an area by intensifying use of resources and space. There is potential employment in recycling and learning how to make uses of resources which have previously been considered as wastes. There is much potential for artisanry and craft work to be developed. Examples of value adding include: spinning and weaving of fibre, paper production, preserving food and making high quality products such as beer, wine, jams and bread.

Local value adding to raw materials would also bring about environmental improvement. The concept of pollution and waste is replaced by that of recycling and reuse. An increased amount of integration of different process allows the by-products of one process to become raw material for another. This is developed in the idea of industrial ecology and living machines below. The regeneration of degraded land and the use of all outputs of the city have economic and job creation benefits. Air, water and soil are cleaned and maintained in a vital, healthy state through the functioning of the community. Urban and community forestry would be fostered, helping to reduce air and noise pollution.

One of the ways in which this value adding and recycling can take place is through industrial ecology.

[Back to the table of contents](#)

6.2 Industrial Ecology

Sustainable design is not about a return to a pre-industrial era, but rather a moving forward incorporating knowledge from the past with modern ideas. Inherent in this combination of techniques from the past with modern technology, is the idea that we can design a better lifestyle than the one we have today. Part of what is required to do this is a rethinking of paradigms about industrial processes, and a redesign of these processes into ecosystems which run on renewable energy.

Hardin Tibbs has described industrial ecology as a shift in industrial patterns which "takes the pattern of the natural environment as a model for solving environmental problems, creating a new paradigm for the industrial system, ...[which involves] designing industrial infrastructures as if they were a series of interlocking ecosystems." (Tibbs,1992: 5).

Tibbs describes which features of ecosystems industry could emulate. These include the idea that there is no waste, only food. Pollution is only an unused output. Nutrients for one part of the system are derived from the death and decay of other parts of the systems. Detritivores and decomposers create essential links and decay is the basis of growth and creativity. Concentrated toxins are only created at the place in which they are to be used and are rapidly assimilated by the system and de-toxified. Materials and energy are constantly circulated and transformed in a cycle. There is very little material flow over great distance as cycling is mainly local. The system is 'dynamic and information driven' and permits independent activity of each element, within an overall framework of co- operation. (ibid.: 6).

Other implications for the spatial organization and energy requirements of a new industry include the placing together of interactive units, such that all of the outputs of one unit serve as the inputs to another. Thus a node of human activity could include an industrial park located close to a decentralized energy source. There is a well developed example of industrial ecology in the Danish town Kalunborg. This is described as combining "a power station, oil refinery, a chemicals company, a plasterboard manufacturer, a greenhouse, a fish farm and local homes and farms" (Allen, 1992: 21). It is design and information which make "the park work like an ecosystem." (ibid.: 22).

Trigger industries are those which make use of a potential resource and cause an increase in jobs and potential businesses in an area. A trigger industry works by providing the information necessary to create links and maximize use of local resources. (Fiske (Integration Compendium, A Sustainable Farm Demonstration for the State of Texas). In order to identify the potential for trigger industries, it is necessary to map the resources, indigenous technologies, and the skills and facilities in an area. Flow charts analyzing local flows of nutrients, materials, energy and information can also be very helpful in this planning process.

The development of industrial ecology parks at the edge of each node of human activity would help to integrate local production, jobs, recycling and energy requirements. These could act as a trigger element for a big change in our relationship to the environment and to work.

One important change in industrial processes could be the copying of natural processes for industrial transformations. This involves using plants, micro-organisms and ecosystems. Many current industrial processes are run at high temperatures and pressures. Natural processes, however, are able to use ambient energy (sunlight) at low temperatures and pressures to create many transformations of materials which could be incorporated into industry. A chemistry PHD student I met at Sheffield University complained that he had devoted three years of intensive research to finding out how to produce a chemical synthetically. He had, however, managed nowhere near as efficient a conversion rate as a plant which produced the chemical during metabolism. We need to learn how to work with the rhythm built into natural processes, producing what we need through elegant and simple biological mechanisms rather than presuming we can do it more efficiently with high technology approaches. A change in industrial practices to using natural processes to produce raw materials could use living machines.

[Back to the table of contents](#)

6.3 Living machines

A living machine is composed of various parts housed within a transparent structure known as a bioshelter. This structure can vary from recycled glass to new light-weight gossamer materials which are able to react to varying conditions of light and temperature. They run on the sun's energy. The parts of a living machine are alive, and include plants, detritivores, aquatic plants and animals, trees and soil. Living machines can be applied at many different levels of scale, from a small greenhouse structure added to an individual house to recycle water and sewage to the level of a sewage works for a whole community.

The natural processes in the living machines can produce raw materials for industrial processes. "Ecologically engineered machines can ... produce by-products which can be used in the manufacture of materials ranging from paper products to advanced composite construction materials." (Todd 1990: 14). Bioshelters can be added to the buildings housing industrial ecology processes in order to absorb carbon dioxide outputs, transforming these into biomass and useful plant products, and also recycling water and organic wastes. We need to learn how not to waste death, but rather how to celebrate cycles and decomposition as the basis for further growth. "Undoing, dissolution, decomposition are accompanied by processes of growth, transformation, and the reformation of elements in new patterns. (Turner, 1967: 99).

One of the main lessons to be learned from nature is the importance of detritivores and decomposers, these need to be incorporated into industrial ecology as the basis of the system. One of the most important aspects of living machines is that they act as a link in recycling and conserving energy and nutrients. Living machines allow us to create a loop to reclaim nutrients using the energy of the sun. Animal filter feeders and detritivores digest wastes, reeds and aquatic plants concentrate metals and break down toxins, cleansing water and making nutrients and materials available for new uses.

Linked living machines can form an important element in reversing environmental degradation of land, helping to de-toxify and regenerate sites, and providing plant material for the development of farms and gardens. Living machines provide the potential for small businesses to grow, both in the processes of reclaiming degraded land and of recycling what is normally considered as waste. They provide many opportunities for creative employment, such that apparent disadvantages can be turned into advantages.

[Back to the table of contents](#)

6.4 energy

We have created an immensely energy inefficient society. This is partly due to a lack of input-output equations for systems' energy requirements in planning. This has especially been the case in agriculture. It takes a huge amount of fossil fuel energy to keep petro-chemical agriculture going. If this is equated along with the energy costs of packaging and transport, it can take almost 8 calories of energy to make one calorie of food energy available to the consumer. It is important to change linear energy equations (where only output and not input is measured) into systems equations, where every use of energy and the cost of pollution is calculated.

There is an important connection between the waste of energy and spatial planning. If elements of a system are far apart, energy is necessary to move materials from one place to another. A measurement of energy use can be an indicator of efficient spatial and system planning.

One of the problems with our industrial-consumer society has not so much been too little energy, but rather too much. It is the seeming abundance of fossil fuels which has allowed us to build ugly, inefficient buildings and design inefficient transport and agricultural systems. Fossil fuel energy allows us to move very quickly and to affect matter very easily. It speeds up our interaction with the land and decreases time spent in contact with natural processes. Working within the limits set by a site's renewable energy sources can be a creative challenge which requires us to come up with elegant and simple solutions, such as passive solar heating for buildings.

A permaculture environment would be run on solar energy as opposed to fossil fuel or nuclear power. Energy patterns which drive permaculture systems show properties of synergy, recycling and interlocking patterns. A high level of flow encourages an exchange of information, energy and materials throughout the system.

Governmental energy policy has stressed larger and larger power plants in ever more more centralized units, at the expense of conservation measures to save energy and the development of renewable energy sources. This centralization of energy sources involves increased energy loss due to inefficiencies and transmission and conversion loss. Large nuclear energy facilities are the culmination of a centralised energy policy. The scale of such facilities removes them from any possibility of local control, and further gives a justification for increased hierarchical and military control. Amory Lovins (1978) has called this type of energy development a 'hard energy path'.

In response, his idea of soft energy paths are "diverse renewable sources that are relatively simple from the user's point of view ... and that are matched in scale and in energy quality to our end use needs... [they are also] environmentally benign , subject to "graceful failure", foolproof (or resilient) and flexible" (Lovins, 1978:478). Small, flexible units which respond to the energy needs of a particular location, population and end- use are designed. These are distributed geographically according to need and supply of renewable energy sources. This idea ties in well with the idea of decentralised industrial ecology units, where energy requirements would be met from wind, wave, solar or bio-gas power supplies. If bioshelters are attached to industrial ecology buildings, energy requirements can further be reduced through passive solar heating.

[Back to the table of contents](#)

6.5 Agriculture

Agriculture could be seen as the most lethal process we have unleashed on the land and upon social structures. "The tedious repetition and endless chores of crop cultivation; the necessity of labouring on and defending denuded, exhausted plots of land from weather, insects and wildlife,...were responsible for the separation of human activity into the duality of work and play" (Lawlor, 1991: 60). Many arguments are posed for the necessity of agriculture to feed a large population, but the reality is rather:"agriculture... drains the fertility of the earth, while insufficiently feeding large numbers of malnourished dependent populations." (ibid.: 62).

Bill Mollison has pointed out that after World War II, factories which had been producing nitrogen for bombs and chemicals for weapons turned their attack on the soil, and the era of modern chemical warfare/agriculture was begun. (1991, BBC Visionaries television programme, *In Grave Danger of Falling Food*).

Petro-chemical agriculture is destructive for many reasons. Increased use of chemicals for controlling pests, diseases and weeds poisons land, water and wildlife. This has been well documented in books such as Rachel Carson's *Silent Spring* (1962), and I do not intend to go into much detail here. Increased reliance on artificial fertilizers has caused a breakdown in soil structure and an increase in erosion and nitrogen run-off, which pollutes water. There has been an increased use of fossil fuel energy to grow food. As illustrated in the *Gaia Planet Management Atlas*, "If every nation expended as much oil per head in agriculture as the U.S., current world oil reserves would be emptied in a dozen years." (Myers 1985: 64).

Large-scale petro-chemical agriculture has a less obvious destructive effect in the form of loss of genetic diversity.

"Genetic erosion is depleting the gene base of many existing crop plants and farm animals." (Myers 1985: 156). There is a danger of widespread crop failure due to pests or diseases wiping out large areas of monocultures, with a potential increase in hunger and political instability.

There is a parallel loss of cultural diversity as farms grow in size in the drive towards bigger corporation holdings, and away from small farms run by families. As a rural way of life is destroyed, people lose contact with the land and with food production. In some countries, rural depopulation sees a corresponding rise in urban populations. Unemployment figures can rise as less people work on the land. What is needed in permaculture is a decrease in size of farm holdings and an increase in the number of people involved in the process of growing food.

If agriculture could be seen as destructive, then an alternative relationship to the land may act as a healing force. Permaculture offers us a system which combines forest farming and gardening with a food- foraging ethic. Food is grown in small scale units where it is required, with an increased emphasis on the importance of gardening. These changes have far reaching consequences for social and economic structures. The spatial and organizational forms of our society are moulded by the way in which we live within natural systems and processes.

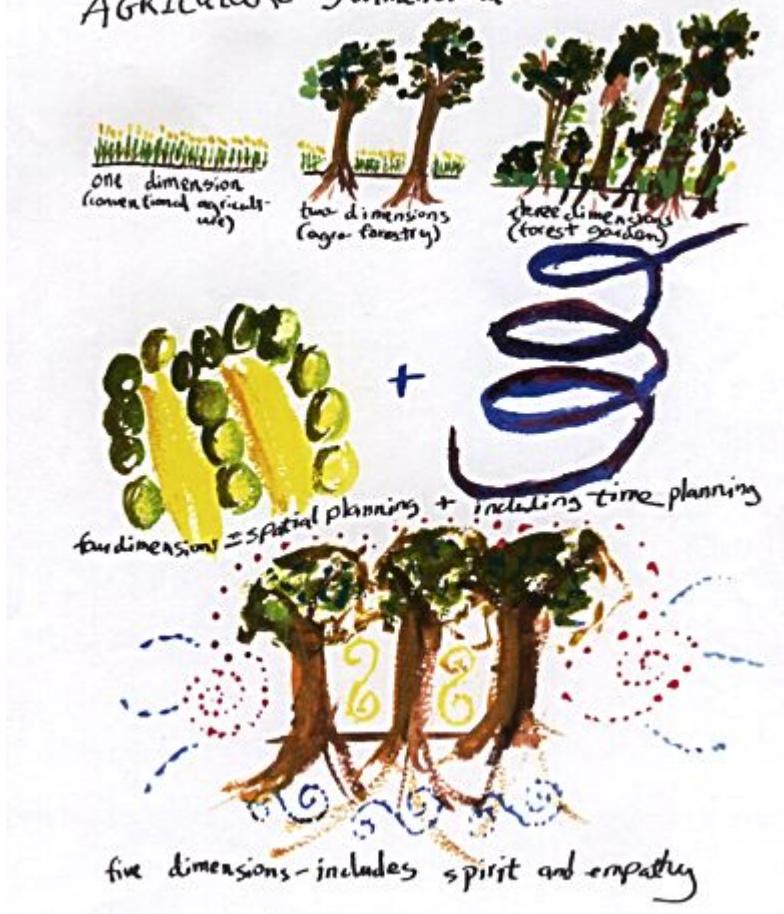
A description by Rabindranath Tagore of Indian society gives an example of a different form of society which is based in the forest and not in the cities.

"Contemporary Western society is built of brick and wood. It is rooted in the city. But Indian civilisation has been distinctive in locating its source of regeneration, material and intellectual, in the forest, not the city. India's best ideas have come where man was in communion with the trees and rivers and lakes, away from the crowds. The peace of the forest helped the intellectual evolution of man. The culture of the forest has fuelled the culture of Indian society" (Shiva 1989: 54).

Permaculture involves an increase in the number of people working on the land, but the work and the form of agriculture would be very different to conventional monocultures. Farm sizes would be small. Farming operations are less brittle and operate at a greater efficiency at a small scale. The farmer is able to know the land and potential resources well and hence make efficient and productive use of them.

Permacultural agriculture makes use of progressively more dimensions. The first dimension uses only horizontal space for agriculture, this can be seen in monocultures of grain or row crops, where there is little use of vertical space. The second dimension involves an extension of planning to include vertical as well as horizontal axes. This can be seen in agro-forestry systems, where trees are grown amongst lower growing crops, making more efficient use of space , nutrients and solar energy. Three dimensional agriculture extends agro-forestry into a forest garden system, where the seven layered structure of the forest is copied and plants occupy every level of space. Trees are grown with under-canopies, undergrowth and herbaceous layers. Vines and creepers make use of the vertical growing space offered by the trunks of trees. Mushrooms are grown in dark corners and sun loving plants are grown in clearings in the woods. Four dimensional agriculture adds time planning to spatial planning, making use of the cycles of evolution, change, and seasonal variation and finding niches in time for different crops. 'Five dimensional agriculture' combines this understanding with an element of 'deep empathy' with the natural systems which make up the farm.

17 INCREASING the POTENTIAL of AGRICULTURE - 5 dimensional thinking



[Back to the list of illustrations](#)

Through an applied understanding of space and time in nature, we are able to see an increasing yield and diversity of products from permacultural systems. "Numerous studies comparing chemical versus organic techniques, such as intensive micro-farming, and three-dimensional space utilization indicate the organic methods achieving yields as high as 31 times those of conventional U.S. farms while using a fraction of the energy, water and other resource inputs. (Fiske (Integration Compendium, A Sustainable Farm Demonstration for the State of Texas): 2). Yield is understood to be a function of maximizing use of space, time and opportunities for integration. The main limit to the yield of a system is wisdom. "Yield is not a fixed sum in any design system. It is a measure of the comprehension, understanding and ability of the designers and managers of that design." (Mollison, 1988: 19).

Forest gardens and polycultures would replace the reliance on very few crops (such as on wheat, rice, maize and potatoes) which we see in modern society. Polycultural agricultural systems allow for benefits of symbiosis, or beneficial interactions between different species and increased resistance to diseases and pests, all of which help to increase yield.

One possible critique of the idea of farming without a heavy reliance on machinery and fossil fuels is that this would involve people in a greatly increased amount of hard physical labour and repetitive tasks. One of the aims of permaculture is to reduce the amount of unnecessary work to a minimum through good planning and design, and through learning to work within natural systems. More people would be involved in working on the land, but this does not have to mean a harsh existence. At the same time, people would be able to work fairly hard physically and remain more fit though the growing of their food.

As biomass and biodiversity increases, the work input of humans decreases, as a system becomes self-sustaining and self-regulating.

Inter-relation- human activity and biodiversity



[Back to the list of illustrations](#)

. The aim of permaculture is to design productive woodlands and ecosystems which are responsive and appropriate to the area. The use of perennials and tree crops allows a reduction of the input of human labour required. Once such a system is set up, the main work required is harvesting and foraging.

One apparent paradox of conventional agriculture is that we often do work which is not only unnecessary, but also harmful. This creates further work in order to clean up the mess created by interfering in natural systems. A Japanese farmer, Masanobu Fukuoka's method was to ask "How about not doing this? How about not doing that?" ... [He] ultimately reached the conclusion that there was no need to plough, no need to apply fertilizer, no need to make compost, no need to use insecticide.... There are few agricultural practices that are really necessary." (Fukuoka 1978 :15).

It is possible to analyse work using flow diagrams to discern how much work is being done and the energy expended in order to complete tasks. Often it is possible to reduce the time spent and the energy expended through spatial planning and integration. If elements in a system are placed such that the outputs of one feeds directly into the other, it is possible to reduce work. Through the careful location of elements, such as the food garden near the kitchen, accessibility is increased and time spent moving around in order to accomplish tasks is decreased.

A polycultural agriculture system could lead to a diversifying of diet, bringing real freedom of choice in terms of foodstuff, not the cosmetic choice between differently coloured and flavoured products on offer in supermarkets today. There is a tremendous potential in the biological storehouse. As a society, we need to learn how to use ecological systems intelligently and to appreciate the importance of biodiversity.

[Back to the table of contents](#)

6.6 Elements of agriculture

6.6i Soil

Soil is the basis of life, and by extension, the basis of civilization. When the soil erodes, chances of a sustainable human community and economy go with it. This was seen in the 'Dust Bowl' of the 1930's in Oklahoma. When the soil blew away, people had to leave in droves to find work elsewhere. Living in cities today, it is possible to think that we can get by without soil. Food comes in in trucks and it seems the agro- chemical companies will make sure it will continue to do so.

There is, however, a limit to how much the soil can give whilst being mined of its natural fertility and organic matter through destructive agricultural practices. Deserts are rapidly encroaching. Globally each year, "some 12 million hectares (of land) deteriorate to a point where they are agriculturally worthless" (Myers 1985: 46). Permaculture offers us the

possibility of reclaiming degrading lands and of pushing back human-made deserts through a variety of methods, in particular learning of the process of natural regeneration and combining reafforestation with water-harvesting techniques. These methods are of central importance. The fertility and health of the soil determines whether or not we will be able to continue to feed and employ ourselves.

One of the most destructive elements of agriculture has been the plough. Soil has a very stratified layering in its natural state. Ploughing inversed this structure and kills micro-organisms, which have very definite positions in the layers of the soil. Arthur Hollins, a farmer who has learned to work without the plough, describes the actions of this soil life:

"a million Actino mycetes,...a hundred thousand minute fungi and innumerable virus, protozoa, ...or tiny algae.... ants, millipedes, springtails and a host of earth dwelling insect larvae....Coupled with the passive and ceaseless writhing of worms, this turbulence ensures the primary mechanical breakdown of organic material and assists the movement of air and water, essential to most life processes." (Hollins, 1984: 233).

Once the rich life of the soil has been destroyed, the farmer has to do its work for it.

Ploughing exposes humus to air where it is rapidly oxidized and burns off, lowering fertility of the soil and reducing its organic content and ability to hold water and nutrients. It creates bare earth which opens the soil to erosion due to wind and rain. Thus, a farmer who ploughs has to work to rebuild the fertility of the soil. Ploughing also turns up weed seeds and creates perfect conditions for their growth, which necessitates more work or the use of herbicides.

In permaculture, the soil remains undisturbed and is allowed to build up its own fertility. Trees within an agro-forestry system help to mulch the soil. A leguminous ground cover crop (such as clover and bitter vetch) is grown as a living mulch. This has the advantages of suppressing weeds, holding moisture in the soil and producing nitrogen as fertilizer directly in situ. The ground cover crop is mowed or grazed by sheep and cows before chisel ploughing, which allows seeds to be planted directly into the soil without inverting it. Thus fertility builds through the natural functioning of soil organisms and plant communities.

[Back to the table of contents](#)

6.6ii Trees

"Les forêts précédent les civilisations, les déserts les suivent" (Chateaubriand).

Sir Albert Howard wrote that we must study the trees in order to learn how to preserve the fertility of the soil. (Berry 1991: 56). Trees create a nutrient rich environment. The thick mulch created by falling leaves provides an ideal place for other plants to grow, with an increased moisture content and a soil structure rich in micro-organisms and humus. Trees also help to conserve water, slowing the descent of rain to the ground so that it has time to infiltrate to a deep layer, with reduced evaporation due to the leaf mulch and sponge-like humus. Tree cover helps to moderate climate and stabilize rainfall. The root structure of trees helps to halt erosion. Trees act as nutrient pumps and help to build soil through the decomposition of leaf-fall.

The planting of trees could be seen as real investment in employment opportunities and in the future.

"The 'tool' with the greatest potential for feeding men [sic] and animals, for regenerating the soil, for restoring water systems, for controlling floods and droughts, for creating more benevolent micro-climates and more comfortable and stimulating living conditions for humanity, is the tree." (Douglas and Hart 1976: 1).

As well as re-learning ancient techniques of sustainable forest management, such as coppicing and wild foods foraging, we need to think of forests for the future, providing raw materials such as natural dyes, medicines, oils and building materials. This will be increasingly important as fossil fuels become more expensive and raw materials increasingly scarce. If we begin planting these forests now, we have a hope of a sustainable future and a high quality of life without fossil fuels.

[Back to the table of contents](#)

6.6iii Animals

Animals can be integrated as part of the agricultural ecosystem. This helps to raise yields and can help to reduce work, by utilizing their natural behaviour within the system.

'Tractors' of duck and geese flocks can be used within an agro-forestry system. They are allowed to roam amongst the growing vegetable and grain crops, kept in place by portable electric fences. This reduces weeds and pests, fertilizes the land and feeds the animals. Yields are increased in the form of eggs and meat.

After crops have been harvested in the agro-forestry rows, sheep and cows can be used in order to graze ground cover crops in preparation for new planting. At the same time, they eat unharvested crops and add fertilizer. Chickens eat weeds, insects and pests. The scratching action of their claws prepares the ground for planting. Thus, further crops in the form of wool, milk, eggs and meat are harvested.

Chickens perform many vital functions in orchards. They eat pests, weeds, and windfall fruit which would otherwise act as the breeding ground for pests and fertilize the trees. Occasional grazing by sheep and geese also helps to reduce weeds. Bees facilitate pollination in the orchard and increase yields with honey and beeswax.

Pigs can be used to turn food scraps into meat. They also make efficient ploughs, and can be used in any area which is being taken over by weeds, clearing the land ready for new planting.

[Back to the table of contents](#)

6.6iv Water

Of the soft and weak things in the world

None is weaker than water.

But in overcoming that which is firm and strong

Nothing can equal it.

(Lao Tzu).

Water would be a central part of any permaculture system, with water sheds re-afforested and ponds dug to collect rainwater across the landscape, thus slowing the rain's descent through the land and allowing it to infiltrate the soil slowly and recharge ground-water supplies. Grey water would be recycled and used for productive aquaculture and wetland gardens.

Aquaculture can be immensely productive. It is possible to stack species into a water polyculture in much the same way as in a forest ecosystem, with edge plants, floating and deep rooting plants. A pond food chain extends from simple microscopic plants to many different types of fish. The edge of water and land is a very productive area, where it is possible to grow trees and many plants useful for fibre, basketry and food.

The landscape would be dotted with ponds and lakes, and rivers would be allowed to follow their natural course, with trees along their banks and on the slopes of the watersheds for flood and erosion control.

[Back to the table of contents](#)

7.0 Patterns of Social Structures

The more restrictive the laws,

The poorer the people,

The more machinery used,

The more trouble in a kingdom .

(Lao Tzu).

Having defined what forms a permacultural community might take, it is necessary to question what structures and institutions may be used in order to implement the changes which could bring this about. The economic and social

institutions discussed in this section could also work to ensure the continued functioning of a sustainable society.

Patterns of social structure define the more nebulous aspects of permaculture, the invisible structures which involves social organisation, community structures and money systems. Inherent in much of this work is an emphasis on increased communication and interaction between people. This can be built into a system through community design and transportation planning. Communication and social interaction are essential to the functioning of green money systems and bioregional organisation. I am aware this discussion touches upon many fields and encompasses issues such as communication systems, computer networks and family structures, but it is outside of the scope of this paper to deal with many of these issues. What is attempted here, is a treatment of many of the issues in social structures which are directly relevant and applicable to the design principles discussed in the earlier section.

[Back to the table of contents](#)

7.1 Money

"The ultimate reduction is achieved when nature is linked with a view of economic activity in which money is the only gauge of value and wealth. Life disappears as an organising principle of economic affairs." (Shiva 1989: 25).

Part of the essential work which must be done in a move towards a sustainable community involves rethinking economic systems.

There is a connection between our money, where we get it from, where we keep and spend it, and environmental destruction and the perpetration of poverty and inequity in the world. We are not acting in isolation. As we are constantly reminded, we act in a global economic arena, which means our actions have wide and often complex repercussions.

Money and energy which can be stored allow the accumulation of power and influence by a centralized elite. Questions of money are also questions of power and control. "To control the cash flow of our societies is to control our lives" (Mollison 1988: 535).

Too much money can be seen as a problem. It can be insidiously destructive in many ways, from diminishing a people's sense of self determination, to a destruction of landscape and culture, "Neither war nor earthquake is so destructive of historic amenities as too much money." (Rackham 1986: 25). Speaking of the Melpa of New Guinea, Andre Strathern states, "Cash, which enables consumption to take place on an unprecedented scale by making it possible to exchange food directly for wealth, might itself be said to stand for potentially cannibalistic values." (Strathern, Andre in Bloch and Parry (eds.) 1982: 116). Cannibalistic values in this sense are associated with a tendency to over-consume, to be too greedy. In the end, cannibalism consumes and destroys the person.

A centralised state seems so entrenched in our way of life that we are accustomed to thinking little of the possibility of a reality without money, banks and governments as we know them. It is, however, possible for poor and disenfranchised groups to take power into their own hands. As Bill Mollison says: "Good people everywhere can take financial and developmental control of their regions, give equal service to all people, and rise from an ethical but outcast sum of minorities to be a driving force in world stability" (Mollison 1988: 535).

We tend to confuse the symbol of money (thin strips of paper, discs of metal) with wealth. Allen Watts has said, "Money is a way of measuring wealth, but is not wealth in itself.... we *invent* money as we invent the Fahrenheit scale of temperature." (Watts 1971: 6 - 7). This is of fundamental importance. Confusion of money with wealth debilitates our sense of what is possible. Wealth is real resources: soil, food, land, skills, water and forests. We need to learn how to create local systems of money to enable us to use the wealth of a region to best effect without relying on aid from a central government.

[Back to the table of contents](#)

7.2 LETS

A system called LETS has been developed in Canada. LETS stands for Local Exchange Trading System, and as the name implies, is a system of money which can only be spent locally. This is important, as it means that local resources are kept available to the population of the area, preventing an exportation of resources and wealth, and it makes it difficult for one region to exploit the resources of another.

LETS builds upon the idea of bartering (the exchange of goods and services). Traditionally, bartering only works if both sides in the agreement actually want what the other has to offer. LETS circumvents this problem through a central marketplace with offers and requests, so that any member of the system can take their pick of the goods and services on offer and is able to offer a wide range of skills, goods and services in return.

LETS allows us to unravel the symbol of wealth from the reality of wealth. It becomes possible for everyone in the community to both work and be able to access the skills and wealth of the region. We currently have a system where there is much work which needs to be done (such as growing food, fuel, timber and fibre; renovating crumbling housing stock, retro-fitting for energy and water efficiency; ecological regeneration and caring for old people and children) and many unemployed people, who often feel worthless and under-valued. LETS could help to alleviate the problem of unemployment, as everyone in a community is able to offer some type of work, without having to be employed full-time by a company. People can offer a variety of skills and goods, and are able to access a region's resources without needing sterling currency.

Each person involved has an account. Every time they buy something, their account goes into commitment. This implies a commitment to do something for the community, as opposed to a debt. Each time they sell something, their account goes into credit. A balance is kept between credit and commitment. A small group of elected trustees keep an eye on the accounts to ensure that no-one enters into too much commitment or credit, and the accounts are always open. Prices are set by the people offering services, and quickly stabilize to levels which people in the community feel to be reasonable. There are many ways of setting guide-lines. The currency can be made to be equivalent of the sterling currency, but often the value would be set more on the value of a person's time. This allows an equalization of the value placed on different people's skills. We live in an odd society when a lawyer's work is valued far higher than the work of a teacher, or a gardener or crafts person. People are encouraged to trade through a lack of interest, this keeps the economy moving and healthy and helps to prevent the accumulation of wealth. There is little advantage in storing green money. LETS could assist in the equalization of wealth within a society.

LETS empowers people to be able to work without relying on a mythical job economy and waiting for a recession to lift. It is possible for people to create their own economic realities, as long as it is done on a local scale. The development of a local economy flies in direct opposition to the trend towards a global economy and free trade across national boundaries. I think it is important to ask the question who will benefit from free trade, the nebulous construct of corporations multinational firms, or people and the environment? The answer to this question could well prove to be an impetus towards a decentralised economy.

[Back to the table of contents](#)

7.3 Networks of information and nodal education

Networks facilitate flow of information and cultural exchange, helping to avoid stagnation and a sense of isolation. An efficient circulation of ideas assists in a flourishing of education. Channels of information can take many forms, from paths and train lines, to information networks or linked community information centres and schools.

The idea of networking of information and the easy flow of ideas stands in contrast to a more traditional idea of hierarchical education and institutions. Naisbitt talks about a process in the 1960's and 1970's, when society's centralized institutions, whose very existence relied upon hierarchies, were crumbling. "In their place, smaller, decentralized units were springing up, linking informally with one another, and therefore relying far less on formal structures" (Naisbitt 1984: 190). He suggests that this is a far more efficient means of information dispersal, and that a networking structure was one of the reasons why the Women's movement achieved some success. "Women clustered together in small groups - usually friends or friends of friends- to reinforce their new self -concepts and thereby alter society's traditional view of women" (ibid.: 191-192).

It is possible to conceive of education as being nodal, with areas of learning in each node of human activity. What I am discussing here is the way in which a form of society based on ecological principles and fractal geometry could effect education. It could become a more de-centralised institution, a part of every day life both for the young and old. Our current education system is severed from the processes of production and community. People are divided into age groups and education is generally not an integrative force within the community. Nodal education would increase the possibility for learning, creativity and innovation for all members of a community.

Each node can be seen as an information fractal, with the processes of agriculture, gardening, crafts and production being accessible for everyone to learn. This is similar to the idea of 'Community Education', which is developed through community groups and night schools, combined with the idea of 'Open University' and the traditional crafts guilds of mediaeval communes, where it was possible for apprentices to become skilled in crafts. Education would not lose its role as an avenue of exploration into many different kinds of thinking and would still extend beyond the scope of practical work. It should, however, involve the sharing of information and ideas across cultural and spatial boundaries, with an increased value placed on work and crafts skills. This corresponds to Ghandi's' idea of education: "Basic Education is a process of learning through doing. It recognizes the organic connection between the fingers, the senses and the mind, and the greater vitality and retentiveness of knowledge that is gained by doing and making things than by merely reading books and listening to lectures." (in Hart 1991: 105).

It is also possible to learn the use of patterns to encode information in forms other than the written word. The pattern of DNA, which encodes the information available to cells in their development towards organisms, is a double spiral helix. This pattern encodes an incredible amount of information in a tiny space. The genetic information required for the development of a tree, human, fish or butterfly is encoded in four basic units through the use of patterning, and made available to cells as they differentiate and are formed by their environment.

"In the case of human societies, the schemata are institutions, customs, traditions, and myths. They are, in effect, kinds of cultural DNA." (Lewin 1993: 15). An apparently simple stone circle, such as Stonehenge, can encode complicated astronomical information which would take encyclopedias of words to record. We can learn to encode, learn and pass on information in the form of patterns, such as "early Aboriginal bark paintings [which] were codes of information through which an Aborigine could visualize a specific topography, the animal species related to that land area, and the clans belonging to that land." (Lawlor 1991: 381). A system of pattern understanding can help make knowledge about design and sustainable practices available to all people within a culture, not just specialists in a field. This would facilitate a devolving of knowledge bases from centralised institutions.

[Back to the table of contents](#)

7.4 Decentralised Government

"By too much trusting to government, they had ceased to trust themselves, they were unable to open new issues." (Kropotkin, 1902: 179)

Rectilinear forms suit centralized and coercive forms of power. That which can be surveyed and easily known can be controlled. Mollison emphasizes a connection between form and organisation:

"A bird's eye view of centralised and dis-empowered societies will reveal a strictly recti-linear network of streets, farms, and property boundaries. It is as though we have patterned the earth to suit our survey instruments rather than to serve human or environmental needs" (Mollison 1988: 95)..

The neatly organized form of modern development corresponds with the highly centralized and hierarchical nature of government and law enforcement in operation in industrial-consumer society.

"At the top of the economic and political power structures are managers and officials so far removed from the concerns and problems of everyday citizens that they may as well be sitting on the moon. The result is widespread civic alienation." (Rothkrug, Paul in Hamilton 1993: 17.).

Highly centralized power structures are brittle and inflexible and are not able to deal with rapidly changing situations and flows of information. The maintenance of a centralised government requires a high consumption of energy, and necessitates an attempt to control information and people. Hamilton calls for a strengthening of "our democratic processes by encouraging the decentralization of large scale power structures and the return of political power to the regions." (1993: 33).

Local self reliance, decentralised knowledge and the networking of information could facilitate the creation of decentralised government structures. A decentralised government would allow people in an area to be involved in decisions which affect them. The people involved are likely to know each other and to be aware of the needs and potentials of their area.

Historically, such decentralised structures have been common in the Western world. Kropotkin describes the medieval commune thus; "not simply an autonomous part of the state, such ambiguous words had not yet been invented by that time.- it was a state in itself. ...It was sovereign in its own affairs."(Kropotkin, 1902: 147).

A movement for change does not need to be imposed from the top- down, as an all-or-nothing approach requiring large scale power structures to devolve power voluntarily. Instead, change can brought about by the accumulation of many small acts of empowerment among individuals and groups. Flexible, decentralised structures slowly replace inflexible

ones in a process of evolution, rather than revolution.

[Back to the table of contents](#)

8.0 Conclusion

8.1 *Difficulty of predicting the future*

In industrial-consumer society, we are constantly extrapolating, counting and projecting into the future in an attempt to predict more and more accurately. "Future-mindedness is as much the distinctive mental habit, and intellectual corruption, of this century as the historical-mindedness that, as Nietzsche pointed out, transformed thinking in the nineteenth century." (Sontag 1989: 174). Futurism is, however, an inexact science, which often creates self fulfilling prophesies. It can be used to justify and fuel an industrialization of life, indeed, "the discipline of futurology lies right at the heart of the old industrial culture" (Beard 1994: 21). Predicting trends in order for corporations to develop markets is a lucrative business. Whenever one is presented with a picture of the future, it is worth asking from whom this picture comes and what influences may be at play in its presentation.

The creation of utopian ideals can be used to obscure processes in the present and to prevent people from effectively deciding upon and creating their futures. As Sam Hall Kaplan has said, "Futurism, I always thought, was an excuse not to do anything now." (Walter et al: 1992: 38). In order to define a clear vision of what one is aiming for with permaculture, it is important to have a sense of a possibility of an improvement in society and design. A balance needs to be struck between working within the framework of a vision, and trying to over-define what a future society would look like. Although attractive, attempts to describe a utopian permaculture future can be damaging, as we do not really know how systems will evolve. A description of utopia can be used to justify many draconic measures by a centralised power force, as being for the future good.

We need to learn how to relax about needing to predict the future, taking trends and extrapolating them as if we were able to predict how they will turn out. Reality is more complex. There are so many elements interacting that we cannot with any certainty predict any one trend. A permacultural understanding also implies that as you make a change to the system, you change the system in an evolving whole. The next change needs to be responsive to the dynamics of the new, unfolding system. Permaculture does not envision a linear projection of change into the future. Feed-back mechanisms make changes more cyclical and surprising results often unfold. A sensitive designer learns to use these feed-back mechanisms and new developments to good effect.

It is impossible to say with any great certainty what a permaculture society based on local economics, an equitable sharing of commons lands and a bioregional ethic would be like. What we can do is move from an awareness that the process with which we support our needs at the moment appears to be inherently life-degrading, and decide to try to make a change in the way we live our lives which may be more life-enhancing.

[Back to the table of contents](#)

8.2 *learning as you go along*

As we make small changes to the system, we will learn from the results of our actions. Permaculture can be seen as a stepping stone on the path towards a sustainable community. Small actions can act as the trigger elements for big changes. As information increases throughout the system and sustainable design strategies are encoded in the physical world, we will become more sophisticated designers. Working within natural systems should provide the knowledge that we will never know everything, and should always be humble enough to learn more as we go along.

[Back to the table of contents](#)

8.3 *Self realization through Positive Action*

Behold the girth of this tree!

It grew from a small filament of a stalk.

This tower of nine stories

has its base upon a small space of the earth.

The journey of a thousand miles

began with a single footstep on the ground."

(*Lao Tzu*).

One of the most important points of permaculture is the need to take positive action. If we see information as a resource, it must be remembered that: "information is only a *potential* resource until it is put to use." (Mollison, 1988 :. 43).

It is better to start small with something you can change and be successful, rather than to never do anything because the magnitude of the problem is overwhelming. By changing yourself and being happy, the positive change you make spreads outwards.

I think that permaculture offers us an essentially positive way forward. Problems are seen as giving the impetus for creative solutions. The magnitude of the social and environmental problems we are facing is so great, that our potential for creative solutions is huge.

The main role I see for permaculture is as a trigger element to get people to start asking questions and not to take the way we live at the moment for granted. I have a certain faith that people can come up with good ideas and will make changes once this process of questioning and observing begins.

One example of the way in which this can work is through thinking about food. Once we realize what rubbish we are eating, a lot of changes can begin to happen. We stick our hands into the dirt and make friends with worms. As we grow food, I feel we will grow in wisdom along with the trees we are planting. Permaculture is about defining a concrete vision for the future, then enforcing it from the centre; but is more about making an analysis of whole systems, then starting to take local actions which are attainable. By creating beauty and enjoying work, we will make other people want to find out more about what is going on and want to change. As more people do so, a diversity of solutions and ideas will evolve.

By encoding a desire for change in real actions, no matter how small, we make it easier for other people to change. Like planting acorns, large trees can grow from small beginnings. We live in a time of much change and instability and I think that permaculture could provide the impetus for a change of state to a much more ecological and sustainable future.

Bibliography

- Aberley, D. (ed.) 1993) Boundaries of Home, Mapping for Regional Empowerment, New Society Publishers, Gabriola Island, BC, Canada
- Alexander, C. et al (1977) A Pattern Language, Oxford University Press, New York, U.S.A.
- Alexander, C. et al (1979) A Timeless Way of Building, Oxford University Press, New York, U.S.A.
- Allen, M. (1994) Ecosystems for Industry, New Scientist, Vol. 141, No. 1911
- Beard, S. (1994) The Futures Market, The Observer Life 3rd April
- Berry, W. (1980) Below in a Part, North Point Press, San Francisco, U.S.A.
- Berry, W. (1991) Standing on Earth, Selected Essays, Golgonooza Press, Ipswich, U.K.
- Bloch, M. and Parry, J. (1982) Death and the Regeneration of Life, Cambridge University Press, U.S.A.
- Bookchin, M.(1982) The Ecology of Freedom, the emergence and dissolution of hierarchy, Cheshire Books, Palo Alto, California, U.S.A.
- Capra, F. (1983) The Tao of Physics, Flamingo, Fontana Paperbacks, London
- Carson, R. (1962) Silent Spring, Hamish Hamilton, London
- Cobbett, W. (1822) Reprinted 1979 Cottage Economy, Oxford University Press, Oxford, U.K.
- Devall, B. (1988) Simple in Means, Rich in Ends; Practising Deep Ecology, Peregrine Smith Books, Salt Lake City, U.S.A.
- Douglas, J. S. and Hart, R. A. de J.(1976) Forest Farming, Intermediate Technology Publications, U.K.
- Douglas, M. (1966) Purity and Danger, An Analysis of the concepts of pollution and taboo, Routledge, London, U.K.
- Downs, R. and Stea, D. (1977) Maps in Minds
- The Ecologist (Vol. 22 No. 4 July/August 1992), Where Community Has Authority, in Reader for Ecological Design 105, Course at Berkeley University, professor Sim Van Der Ryn

- Fiske, P. Sustainable Design Compendium, Center for Maximum Potential Building Systems, Austin, Texas
- Fiske, P. Integration Compendium, Center for Maximum Potential Building Systems, Austin, Texas
- Fukuoka, M. (1978) The One Straw Revolution, An Introduction to Natural Farming, Rodale Press, Emmaus, U.S.A.
- Gac, P. (9178) Celtic Dwellings, pp 42 - 43 in Shelter II, Shelter Publications, Bolinas, California, U.S.A.
- Gold, J. (1980) An Introduction to Behavioural Geography
- Gleick, J.(1987) Chaos, The Making of a New Science, Sphere Books, London
- Gleick and Porter (1991) Nature's Chaos, Cardinal, London
- Hamilton, J. (1993) The Song of the Earth, A Permaculture Design of a Sustainable World System, Vermont College, Norwich University, Montpelier, Vermont
- Hardin, G. (1968) Tragedy of the Commons, Science No. 162,pp. 1243-1248
- Hart, R. A. de J.(1991) Forest Gardening, Green Books, Devon, U.K.
- Harvey, D. (1989) The Conditions of Postmodernity - An Enquiry into the Origins of Cultural Change
- Hawken, P. (1992) The Ecology of Commerce, Inc. Magazine, April 1992
- Hawken, P. (1994) A Declaration of Sustainability, Utne Reader pp 54 - 61, September/October 1993
- Hockey, J. (1990) Experiences of Death, An Anthropological Account, Edinburgh University Press, Edinburgh, U.K.
- Hollins, A. (1984) The Farmer, The Plough and the Devil, The Story of Fordhall Farm, Pioneer of Organic Farming, Ashgrove Press, Bath, U.K.
- Illich, I. (1976) Limits to Medicine, Medical Nemesis: The Expropriation of Health, Marion Boyars, London
- Kim, A. and Clifford, S. (1985) Holding your ground, an action guide to local conservation, Wildwood House, U.K.
- Kropotkin, P. (1902) Reprint 1987 Mutual Aid, A Factor of Evolution, Freedom Press, London, U.K.
- Kropotkin, P. (1906) Fields, Factories and Workshops, Swan Sonnenschein, London, U.K.
- Lao Tzu, (translator) Mears, I. (1922) Tao Teh King, Theosophical Publishing House limited, London
- Lappe, F. M. and Collins, J. (1986) World Hunger, Twelve Myths, Earthscan Publications, London
- Lawlor, R. (1991) Voices of the First Day, Awakening in the Aboriginal Dreamtime, Inner Traditions, Rochester, Vermont
- Leopold, A. (1949) A Sand County Almanac, Oxford University Press
- Lewin, R. (1993) Complexity, Life at the Edge of Chaos, JM Dent Ltd. , London
- Lovins, A. (1978) Soft Energy Technologies, Annual Review of Energy, U.S.A.
- Mollison, B. (1988) Permaculture, A Designer's Manual, Tagari Publications, Tyalgum, Australia
- Mollison, B. (1993) The Permaculture Book of Ferment and Human Nutrition, Tagari Publications, Tyalgum, Australia
- Mudimbe, V.Y (1988) The Invention of Africa; Gnosis, Philosophy and the Order of Knowledge; Indiana University Press, Indiana, U.S.A.
- Myers, N. (ed.) (1985) T he Gaia Atlas of Planet Management, for today's caretakers of tomorrow's world, Pan Books, London
- Naisbitt, J. (1984) Megatrends, Ten new directions transforming our lives, Futura, Mc Donald and Co. London
- Parkin, D. (1982) Semantic Anthropology; Academic Press, London
- Pullen, M. (1992) Linking Farmers and Consumers, International Society for Ecology and Culture, U.K.
- Rackham, O. (1986) The History of the Countryside, the classic history of Britains landscape, flora and fauna, JM Dent, London
- Rappaport, R. A., Scientific American, The Flow of Energy in an Agricultural Society in Reader for Ecological Design 105 Course at Berkeley University, professor Sim Van Der Ryn
- Rousseau, Pleiade vol. 3
- Parkin, D. (1982) Semantic Anthropology Academic Press, London
- Schechner, R. (1993) The future of ritual, Writings on culture and performance, Routledge, London
- Shields, R. (1991) Places on the Margin - Alternative Geographies of Modernity

- Shiva, V. et al (1986) Social Forestry - no solution within the market, The Ecologist
- Shiva, V. (1989) Staying Alive, Women, Ecology and Development, Zed Books, Bath
- Snyder, G. The Practise of Wildness, in Designing Sustainable Solutions (1993) in Reader for Ecological Design 105, Course at Berkeley University, professor Sim Van Der Ryn
- Sontag, S. (1977) Illness as Metaphor, Penguin Books Limited, London
- Sontag, S. (1989) Aids and Its Metaphors, Penguin Books Limited, London
- Tibbs, H. (1992) Industrial Ecology, An Environmental Agenda for Industry, Whole Earth Review, Winter 1992 pp. 4-19
- Tippett, J. (1993) Permaculture and Wholeness, The Nature of Order and our Order Within Nature (Unpublished Paper)
- Todd, N. and J. (1984) Bioshelters, Ocean Arks, City Farming, Ecology as the Basis of Design, Sierra Club Books, San Francisco
- Todd, J. (1990) Living Machines, Annals of Earth, Vol. VIII, No. 1, 1990
- Turner, V. (1967) Forest of Symbols; Kingport Press, U.S.A.
- Turner, E. (ed.) (1985) On the Edge of the Bush, Anthropology as Experience, University of Arizona Press, Tucson Arizona, U.S.A.
- Walter, B. and Arkin, L. and Crenshaw, R. (1992) Sustainable Cities, Concepts and Strategies for Ecocity Development, Eco-Home Media, Los Angeles, California, U.S.A.
- Watson, L. (1991) Gifts of Unknown Things, A True Story of Nature, Healing, and Initiation from Indonesia's Dancing Island, Destiny Books, Rochester, Vermont, U.S.A
- Watts, A. (1971) Does it Matter ? Essays on man's relationship to materiality, Vintage Books, New York, U.S.A.
- Whitelegg, J. (1993) Transport for a Sustainable Future, The Case for Europe, Bellhaven Press, London
- Wintour, P. (1994) Britain 2020: Roaming wolves and metered noise, The Guardian, Tuesday, April 5, 1994

[Back to the table of contents](#)

Appendix

Permaculture ethics and principles of design by Joanne Tippett

Permaculture is the conscious design of self sustaining, bountiful landscapes. Plants, animals, buildings and water resources are coordinated to make the best use of a site's terrain, to establish beneficial relationships and to make the most efficient use of time and resources in an environmentally benign way. Elements are placed in a design to serve many functions and each function is attained in a number of ways. (Permaculture Institute of North America)

The Ethical basis of permaculture centres on three things: earthcare, people care and sharing surplus.

Earthcare is of vital importance. Not only is it important that we reduce our harmful impact on the earth (in terms of pollution and environmental degradation), it is also vitally important that we protect the natural resources we have left, create new natural areas and reclaim degraded lands. Ecological design is involved in regenerative work, the actual creation of systems which produce energy, food, clean water and wildlife habitats. A prime directive of permaculture is to reduce the amount of land required by humans to obtain their needs, using a variety of methods, and to return as much land as possible back to natural areas.

The basic idea of people care is allowing all people to have access to the resources necessary for a good quality of life. Permaculture aims to develop healthy, co-operating communities, amongst people as well as plants and animals, to create a good quality of life, and to empower people to improve their situation through their own efforts.

Sharing surplus is important as sustainability is not possible while there is a high consumption of material goods.

1 Learning from nature

Examples of this include observing the structure of a forest, the way the trees grow, the species which grow well together, and the highly productive complex structure. Understanding this, we are able to design productive forests around our settlements which provide food, medicine, fuel and raw materials; such as timber and dyestuffs. These can be on the macro-scale, in agro-forestry or large community forests, or on the micro-scale, designing forest gardens in small back

yards. These gardens can be beautiful, productive, extremely low maintenance and attract a large range of wildlife. Indeed, all gardens should be designed with the local wildlife in mind, including habitats for birds, insects and small mammals. We are then able to learn more from nature by coming in contact with it on a daily basis.

2 Minimum effort for maximum return

We need to re-define our idea of work. It seems that we are working harder and harder in order to accumulate things, without having the time to really enjoy ourselves. We need time to dance, sing, talk and actually enjoy the world around us. Often we are doing work which is unnecessary (such as mowing the lawn, digging in gardens, weeding or spending endless hours pushing shopping trolleys around supermarket).

3 Good planning and design

It is important to have an overall plan of the elements in a system, so that each element works together in order to save work and increase productivity. For example, if the chickens are near the vegetable garden and higher up a slope, it is easy to transfer the manure to the garden. Growing nitrogen fixing trees (also good for fuel as they grow rapidly) with fruit trees increases the productivity of the fruit trees by improving the fertility of the ground. If the different types of trees were grown separately, this benefit would not occur.

4 Use of biological resources

If I need it, I plant it. Wherever possible, resources which can reproduce themselves and utilize the sun's energy are used.

5 Energy recycling

Whenever possible, loops are made in the system so that energy is conserved, reused and recycled.

6 Relative placement

Every element in the system is positioned in relationship to the other elements in order to receive the maximum benefit from working together as a whole, for example, place the greenhouse to the south of the house in order to increase passive solar heating.

7 Minimal tillage (ploughing and digging) and use of perennial plants

This allows the fertility of the soil to increase naturally, and allows the worms to do work for us. The process of digging and ploughing increases erosion, destroys the structure and fertility of the soil and turns up weed seeds. Perennial plant systems can be relatively self-regulating once they are set up. the role of the gardener evolves to forager.

8 Zone and sector analysis

The relative positioning of elements within the system is highly important. Work can be reduced and productivity increased through the spatial positioning in design. One way in which this understanding can be utilised is through zones in permaculture planning.

Zones are rather like a series of concentric circles radiating out from the house or area of habitation. The inner circle contains that which needs to be visited most often and that which we need greater access to, such as the vegetable garden. This idea is greatly modified on site by local conditions, but is important to bear in mind overall. In general, in zone one there is intensive food production; zone two includes less frequently cropped vegetables, fruit, orchards, ponds, trellises, and any livestock which needs regular attention. If the site is large enough, zone three includes any larger scale agricultural production, zone four is a woodland for raw materials, fuel, food etc. The fifth zone is for wildlife. Every design should have at least one corner which is devoted to local wildlife. This can occur throughout the property and indeed the whole site can be designed to include native species and habitats. It is also important to create wildlife corridors, connecting any wildlife areas together to enable species to migrate.

Sector analysis requires an understanding of how energy is flowing on to and off the site. This involves the connections of the site to the wider local environment. Wind, water, sunlight and rain all affect the design. Sector analysis allows these to be used to the utmost. For example, placing a windbreak in the right position can reduce the amount of heating costs considerably. If the house is facing the sun, passive solar heating can be gained and lighting costs reduced. A pond to the south of a building increases sunlight reflection to the house, and therefore daylighting and passive solar heating.

Slope and elevation analysis is also important. Water flows downhill and can be stored above the settlement. All

rainwater flowing through a site can be collected and stored in ponds on the site to be released slowly downhill, used in the meantime for aquaculture. Steep slopes need to be planted with trees in order to prevent erosion. The lower slopes of hills and the flood-plains are the most fertile areas for agriculture.

9 The importance of the garden

Gardening is the most productive form of agriculture, and if widely practised would reduce the amount of land necessary for our own needs (freeing more land for natural regeneration and wildlife). Gardening is possible everywhere, suburban lawns could be transformed into beautiful, productive landscapes. Many balconies, roofs, window-sills and areas of waste land in the city can be turned into small gardens.

10 Understanding patterns

This involves learning from the patterns of nature and applying them to designs in order to create beautiful areas, facilitate energy flow and increase productivity. It also involves understanding which patterns create beautiful and functional human habitats, and learning how to code and transmit information in patterns.

11 Multiple sources for each need and uses for each element in the system

This increases stability and the yield of a system.

12 Stacking and maximum use of space

Use all space to the maximum effect, for example, grow plants up walls or trellises, copy the structure of the forest for maximum production.

13 The problem is the solution

Make the most of what you have and use apparent problems to your advantage, coming up with creative solutions in order to turn them into assets. Think positively, if you don't believe you can change things for the better, you certainly won't be able to.

14 "There is only one corner of the universe you can change, and that is yourself, but in changing that corner, you change the universe." (Indian proverb)

It is better to start small with something you can change, and be successful, than to never do anything because the magnitude of the problem is overwhelming. By changing yourself and being happy, the positive changes you make spread outwards, as a grass roots revolution. The sum of many small changes is a large change, and we need to start right away.

[Back to the table of contents](#)

[back](#)