Ecology and Community Design

With Special Reference to
Northern European Ecological Communities

Todd D. Saunders

School of Architecture
McGill University
Montreal
March, 1995

A Thesis Submitted
to the Faculty of Graduate Studies and Research
in Partial Fulfilment of the Requirements
of the Degree of Master of Architecture

ISBN 0-612-05344-X

Abstract

I write this thesis based on the premise that many environmental problems are the result of conventional community design. I argue that conventional community designs are "anti-ecological" because they consume too much energy, produce an extraordinary amount of waste, are car-oriented, ignore any relationship with the natural environment, and reflect the irresponsible attitude of man conquering nature. However, I suggest that ecologically responsible community design alternatives do exist I refer to these alternatives as "ecological communities". These communities attempt to function as ecosystems that conserve natural resources, are self-regulating, and produce little waste.

I present the central principles of ecological communities, and then explore the validity of these assertions. Using five ecological communities from Northern Europe, I examine the following principles: 1) alternative energy systems at the community-scale, 2) wastewater treatment and water reclamation, 3) waste management in the community, 4) ecologically sustainable landscapes, and 5) environmentally responsible housing.

Finally, I present my observations and conclusions. The observations are intended to help community designers to understand the characteristics of ecological communities, and perhaps some of the conditions necessary for these communities to exist. The hope is that these observations may assist community designers avoid common mistakes on similar projects. The observations may shorten the time designers require to transfer their ideas from theory into practice. I conclude that when compared with conventional communities—not with perfection or the utopian dream—ecological communities and what they represent can provide designers with viable development alternatives.

Résumé

J'écris cette thèse en partant du principe que maints problèmes écologiques sont le résultat de desseins communautaires conventionnels. Je soutiens que ces derniers sont anti-écologiques parce qu'ils consomment trop d'énergie, produisent énormément de gaspillage, favorisent l'utilisation des automobiles, ne respectent pas le rapport avec le milieu naturel et reflètent l'attitude irresponsable de l'homme vis-à-vis sa conquête de la nature. Néanmoins, je suggère que de sensibles alternatives de desseins communautaires écologiques existent. Je fais référence à ces alternatives comme "communautés écologiques". Ces communautés tentent de servir comme écosystèmes qui conservent les ressources naturelles, sont autorégulatrices et produisent peu de déchets.

Je présente les principes centraux des communatés écologiques et ensuite examine la justesse de ces affirmations. En me servant de cinq communautés écologiques en Europe de Nord, j'examine les principes suivants: 1) des systémes d'énergie alternative sur l'échelle communautaire, 2) le traitement et la récupération d'eaux usées, 3) l'exploitation du gaspillage dans la communauté, 4) des paysages écologiques soutenables, et 5) le logement favorable à l'environnement.

En terminant, je présente mes observations et conclusions. Les observations se proposent d'aider les dessinateurs (concepteurs-projeteurs) de communautés à comprendre les caractéristiques des communautés écologiques et peut-être queiques-unes des conditions nécessaires pour l'existence de celles-ci. L'epsoir est que ces observations puissent assister les dessinateurs afin qu'ils évitent les erreurs courantes dans des projets semblables. Les observations peuvent réduire le temps requis des dessinateurs pour transférer leurs idées de la théorie à la pratique. Je conclue que lorsque nous comparons les communautés conventionnelles—excluant le désir de la perfection, voire l'utopie—, avec celles écologiques et ce que ces dernières représentent, les communautés écologiques peuvent offrir aux dessinateurs des alternatives de développement viables.

Acknowledgements

There are many people who helped make this thesis possible. In particular I would like to thank Adrian Sheppard of the School of Architecture at McGill University for his moral support and guidance and Jill Grant of the Department of Environmental Planning at the Nova Scotia College of Art and Design for her comments and encouragement she gave me for this study and over the years.

I am greatful to the American Institute of Architects, Canadian Scandinavian Foundation, and McGill University for their financial support, without which I would have not been able to conduct a study of this character.

A number of people have kind been enough to read the manuscript in its various stages and offer their observations. These include Christian De Laeth, James Drescher, Gillian Grey, Darrell Joudrey, Eugene Meese, Jennifer Scott, Matthew Starnes, Andrew Whitemore, and John Zuck. Their efforts have helped me eliminate many errors in initial drafts.

I wish to thank the residents of the five communities in this study for providing the data, many of the ideas, and the inspiration to write this thesis. In particular, I wish to extend my utmost thanks to the residents of Vallersund Gård, Norway and Järna, Sweden for so openly providing the best of Nordic hospitality during my extended stays. I cannot express how much I admire the residents of all five communities for their convictions and especially their actions.

Finally, I wish to thank my parents for their encouragement and support. And to the graduate students at McGill University School of Architecture for the friendships and experiences we have all shared. I am convinced the world will profit from your courage and aspirations.

Todd

Contents

List of Figures

CHAPTER FOUR

1

Introduction

1.1 Research Problem

My interest in writing this thesis originates from a long-term involvement with the subjects of *ecology* and *community design*. Designers often face the paradox that sometimes the most ecologically desirable decision is not to build at all (Kareoja, 1993). In search of a solution for this paradox, I have discovered that architectural and planning theorists develop most ecology and community design concepts in North America. While these works confirm the need for an alternative approach to design, solutions put forward often do not address practical concerns and are highly theoretical. I will argue in this thesis that community designers can engage in alternative practices to create a better relationship between the built and natural environments. I will demonstrate this point by bridging theory with practice.

An increasing number of researchers argue that society has become wasteful and consumptive, without any regard for the future. Because we are oriented towards an irresponsible way of living, we have built communities based upon this attitude. Conventional community designs consume too much energy (Nijkamp and Perrels, 1993), produce an extraordinary amount of waste (Girardet, 1993), are car-oriented (Engwicht, 1993), ignore any relationship with the natural environment (Hough, 1990), and reflect the irresponsible attitude of man conquering nature (Hahn and Simonis, 1991). As a result, conventional community designs are, as Krier (1987) defines them, "anti-ecological". For these reasons I have become disenchanted with the way communities are designed, and have decided to research alternative design solutions.

One alternative to conventional community design can be referred to as "ecological communities". In accordance with my own research and others, I suggest that ecological communities occur when the following criteria are met. Ecological communities apply *renewable energy technologies* at the community-scale. These communities experiment with *alternative* *sewage and treatment systems.* People living in ecological communities practise *recycling and waste recovery* as a way of life. Ecological communities attempt to *work in conjunction with natural surroundings* without disrupting natural features (eg. soil, water, natural vegetation, and habitat). Basically, ecological communities attempt to function as ecosystems in that they establish cycles that conserve natural resources, are self-regulating, and produce little waste.

This study examines built ecological communities in Northern Europe. There are three overriding reasons for applying case studies to this thesis. First, an examination of case studies allows me and other designers to capitalize on existing practical expertise in the creation of ecological communities. Second, an examination of case studies encourages a stronger relationship between designers and academic scholars. Many scholars believe that if research is conducted with the practitioner in mind, the chances of theoretical research diffusing into the "real world" increase tremendously (Turner, 1976). Third, there are no built ecological communities in Canada, although many architects and planners profess an interest in both ecology and community design. In Northern Europe, however, we find a long tradition of ecological community design, with a large palette of academic and practical research to draw upon.

In preparing an argument supporting ecological communities as an alternative to conventional community design, I do not suggest that ecological communities are an answer to current environmental problems, or that these communities will meet the needs and desires of all. The theories and case studies presented in this thesis are not intended as a "how-to" guide to ecological community design. Rather I believe designers can emulate and utilize the concepts and creative responses from these case studies in their own particular situations. In short, I believe when compared with conventional communities, ecological communities are not utopian, but do offer design solutions to some environmental problems.

1.2 Research Question

I write this thesis on the premise that many environmental problems are the result of conventional community design. I suggest that designers can engage in alternative community design practices that create a better relationship between the built and natural environments. If designers can create "ecological communities", I assert that we can solve some environmental problems associated with the way designers normally create communities. These assumptions raise the following questions: *What are ecological communities? What are the guiding principles of viable ecological communities? Why do we need ecological community design? Then - the main research question - what can we learn from the ecological communities examined in this thesis?*

1.3 Study Method

In order to answer these research questions, I employ a four-part study method. In the first stage of the study a review of the relevant literature outlines the issues and provides a basis from which a discussion on ecological communities will proceed. This section includes a definition of the term "ecological community" and gives reasons why we need such a community design philosophy and practice.

The second stage of the thesis outlines the guiding principles of ecological communities. The guiding principles include 1) renewable energy technologies at the community scale; 2) wastewater treatment and water reclamation; 3) waste recovery in the community; 4) ecologically sustainable landscapes; and 5) environmentally responsible housing. This section provides the basis of discussion for the case studies and the remainder of the thesis.

The third stage is the case studies of five Northern European ecological communities. In preparation for the field study conducted from May to August 1994, I contacted researchers involved with similar work regarding ecological community design in Northern European countries. Diane Gilman, co-author of *Eco-Villages* (1991) for the Context Institute near Seattle, Washington, provided me with a list of names and information regarding what she considered model ecological communities. Kevin Connery, a recent graduate form the Master of Landscape Architecture Program at the University of British Columbia, supplied me with similar information. I wrote specific individuals and organizations who undertake work on ecological community design or who are living in an Northern European ecological community. While in Denmark, I met with David Van Vliet, a Ph.D. student from the University of British Columbia Department of Urban Planning, who shared information and helped me contact architects and planners who design ecological communities. All of these people gave me tremendous amounts of information and personal insight that has been invaluable in the preparation of this thesis.

During my field research, I visited approximately fifteen ecological communities; I will examine five in this thesis. They are Ecolonia, in Alphen aan der Rijn, The Netherlands, Lebensgarten, near Steyerberg, Germany; Frasenweg, in Kassel, Germany; Vallersund Gärd, Norway; and Järna, Sweden. During the site visits, which ranged from three days to five weeks, I interviewed the architects and planners to acquire general facts and to determine the limitations and problems confronting designers wishing to put their ecological principles into practice. These people shared with me relevant articles and studies. I undertook an extensive photo documentation, made field notes and sketches. In almost all the case studies, I discussed aspects of the community with members, and in some cases talked with neighbours. In some communities, I worked with members to help minimize travel costs. In Vallersund Gärd, Norway, I designed and supervised a construction project over a period of five weeks, which presented me with an opportunity to get an insider's view of an ecological community. At each community I documented as much information as possible pertaining to the five guiding principles outlined in the second stages of this research (see page 25). The information I collected gave me an opportunity to examine each community in its fullest, in spite of time constraints.

The five case studies I review were selected in regards to most of the following criteria: 1) each study demonstrates a contrasting approach in order to reflect a wide spectrum of implementation strategies, costs, and locations; 2) in each community there are a number of published documents, particularly pertaining to the fields of architecture and planning; and, 3) prior to visiting the communities, I had written responses from professionals of each community agreeing to contribute first hand to my research (see appendix A).

The case studies are representative of Northern European ecological communities, but should not be considered exhaustive. Other ecological communities that I visited can be considered as equally viable. My intention was to select the "state of the art" on the basis of the criteria listed above. There are, however, various reasons why I exclude certain communities: 1) I did not spend enough time in some communities; 2) I was unable to acquire sufficient information about some communities, and; 3) some communities were incomplete, or only in their infant stages of development.

The fourth and final stage summarizes the findings of the study, based on the literature review and the case studies, and presents my observations. The observations are intended to help community designers to understand the common characteristics of ecological communities, and perhaps some of the conditions necessary for these communities to exist. Ultimately, the findings will present the reader with what we can learn from ecological communities.

1.4 Scope and Limitations of the Research

This thesis concentrates mainly on the physical aspects of ecological communities with some reference to the social aspects. While my education in architecture and environmental planning provides me with knowledge best suited for examining physical elements, I fully understand that physical aspects represent only one dimension of ecological community design.

Due to the fact that I conducted the case studies in four countries over a period of three months, I had to deal with many limitations. First, the quality of information I present reflects the time I spent in each community; some visits lasted longer than others. In retrospect I believe that in order to analyze ecological communities, it would be more appropriate for the researcher to stay in such places for longer periods of time. Second, much of the literature on the communities is published in a number of languages, thus posing a language barrier. During the field visits, however, I was able to either use English or German. As a result, many of the facts on the case studies are based upon first-hand sources of data I gained from interviews and field observations. Third, it is beyond the scope of this study to investigate the costs of ecological communities. Many of the communities are the product of self-help. Thus, the generosity of residents and some professionals made it difficult to assess the cost of the ecological communities studied. Finally, with reference to the five case studies, which were all designed under different circumstances, I wish to emphasize that this study is not a comparative one, or determine which communities are more successful.

1.5 Outline of the Thesis

This thesis contains six chapters. Following an introductory chapter, chapter two outlines the central issues in the study of ecology and community design. It provides a definition of an "ecological community" and reasons why we need these communities. The third chapter describes in detail five guiding principles of ecological communities. The fourth chapter presents the case studies and examines each community in accordance to the guiding principles outlined in chapter three. The fifth chapter offers general observations regarding ecological communities The sixth and final chapter gives a personal epilogue.

2

Central Issues

2.1 What are Ecological Communities?

"Ecological community" is not a common term in the field of architecture and planning, and as such requires some definition. Ecological communities share similar principles with concepts created by other researchers, which include Green Cities (Gordon, 1991), Ecological Villages (Gilman and Gilman, 1991), Sustainable Communities (WCED, 1987), and Eco-Cities (Register, 1987). I chose ecological community as a generic term since all definitions available have common features. These researchers, who look for new ways to integrate artificial environments with natural environments, study human settlements as ecosystems. Viewed as ecosystems, human settlements should be energy efficient, produce little waste, and be self-reliant; much the same as ecosystems appearing in nature.

There is a handful of designers and researchers developing theories based on the idea of the community as an ecosystem. Girardet (1992) considers a community to be ecological when it adopts a circular metabolism, whereby outputs of the system are equal to the inputs, thus only affecting a small area (Fig.2.1). In describing what places with a circular metabolism would be like, he writes:

> Sewage systems cease being disposal systems for noxious mixtures of household and factory liquid wastes. Toxic liquid wastes are kept separate from "valuable" household sewage and washing powders, cleaner, and bleaches are fully biodegradable. Sewage works are designed to function as fertilizer factories rather that a disposal system for unwanted, often, poisonous, discharges. Liquid chemical wastes from factories are treated separately or no longer used, encouraging companies to invest in recycling technology and non-toxic production. Household and factory rubbish is regarded as an asset rather that an encumbrance and recycling is integral

rather than an optional "add on" feature (Girardet 1992: 23)

In addition to these features, Girardet imagines these places to have low water consumption from unpolluted sources, responsible energy systems, building materials that are reused and recycled, and trees replanted.

Circular Metabolism — Ecological Communities

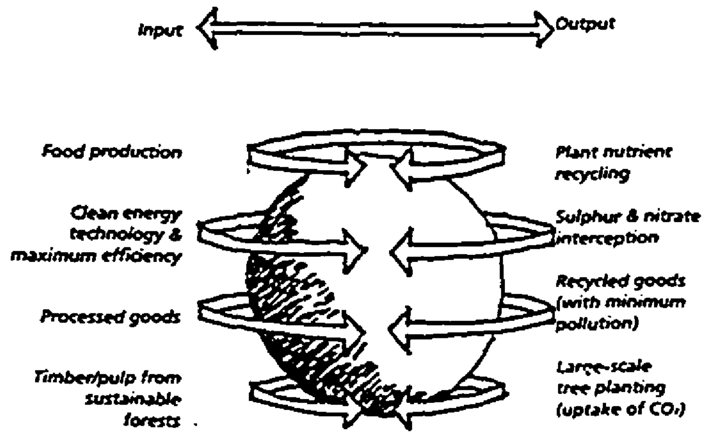


Figure 2.1: A conceptual diagram of a community with a circular metabolism (Adapted from Girardet, 1992)

Robert and Diane Gilman (1991) have researched a number of ecological communities worldwide. Although they focus on the social qualities, their research also examines ecological aspects of these communities. The authors suggest that in ecological communities humans attempt to find a proper place in nature, instead of trying to create a domination over nature. The second principle of their ecological community refers to the cyclic use of resources. Similar to Girardet (1991), the Gilmans claim that a community can become more ecological by adopting a cyclic function by utilizing natural energy resources such as the sun and the wind, and reducing the amount of garbage entering the waste stream by composting organic waste, and recycling and reusing materials. They define an ecological community as:

> a human-scale full-featured settlement in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development and can be successfully continued into the indefinite future (Gilman and Gilman 1991: 7).

The authors recognize that this definition may conjure up images of the "good old days" or a return to rural values. So, they suggest that ecological communities should be distinctly progressive to confront contemporary problems. They admit that their definition includes aspects and lessons gained from communities of the past, but insist that ecological communities are by no means an attempt to recreate a traditional way of life.

Ekhart Hahn and Udo E. Simonis (1991) contend that a continual ecological deterioration is underway as a result of irresponsible approaches to the use of land. In opposition to these destructive practices, the authors devise a set of comprehensible guidelines on ecologically compatible design. One of their guidelines requires designers to adopt design strategies that emulate natural processes. They suggest:

> Nature is the most economical and ecological architect. Its products are harmoniously placed into energetic and material cycles, optimally adapted to local conditions. Builders, architects and city planners should again learn from "nature's intelligence". When choosing building materials and designing products it is important to consider the whole production, consumption and deposition cycle and its effects on people and the environment. Corresponding substance -value factors should be integrated into all planning activities (Hahn and Simonis 1991: 203).

The authors found that in order to achieve an ecologically compatible society, the challenge facing society and designers is not only technical, but also one of lifestyles and societal values. In their view, there is a reasonable chance that changes toward ecological compatibility will be incorporated into society and design over the next decade.

Among others developing theories involving the relationship between ecology and community design are landscape architects. Ian McHarg's *Design with Nature* (1969) set the precedent by urging landscape architects and other designers to carry out conscious and informed decisions when placing artificial features in the natural environment. From the teachings of McHarg came two other designers elaborating on similar theories in the relationship of ecology and design. Anne Spirn, author of *The Granite Garden: Urban Nature and Human Design* (1983), and John T. Lyle, author of *Design for Human Ecosystems* (1985) both encourage designers to create spaces that imitate the functions of nature: cycles, dynamic equilibriums, and the eloquence of natural processes. Unlike conventional designers, Spirn and Lyle see humans as inseparable from nature, and realistically point to the fact that design cannot exist without ecological intervention. Both authors are convinced, however, that human design can occur without severely altering existing ecologies.

In accordance with the authors discussed so far, I have devised the following definition of an ecological community. As briefly mentioned in the Introduction, an ecological community exists if it: 1) applies renewable energy technologies—such as solar energy, combined heat and power schemes, or wind-generated electricity rather than fossil-fuel-related energy supplies; 2) uses alternative sewage and wastewater treatment systems; 3) strives to work in conjunction with natural surroundings without disrupting natural features (eg. soils, water, natural vegetation, and habitat); 4) attempts to function as ecosystems that conserve natural resources, are self-regulating, and produce little waste. Furthermore, people living in ecological communities practise recycling and waste recovery as a way of life. In sum, ecological communities are designed to imitate the efficiency in nature, where there is a balance of inputs and outputs of energies, products, and waste. And, ideally, the surplus of these materials is still valuable to the community.

In chapter Three, I will revisit the definition of ecological communities in more detail and outline principles of ecological community design. But first, I would like to discuss the term "community" in ecological community.

2.2 The Meaning of Community

The definition of community is ambiguous in many fields of research. Bender (1978: 5) cites George Hillary (1955) who found 94 definitions of community. For the design field, the term often has spatial connotations, including number of persons, schools, churches, public buildings in one geographic location. Shiefloe (1990: 95) points out that this spatial understanding of community has caused the design profession to "work on the basis of false assumptions as to the importance of local ties and the possibilities to plan for social integration." In this manner, designers often create physical spaces that lack any opportunities for social interaction or enhancement.

This scenario, however, has not been always the case. Architectural and planning thinking have been influenced by utopian theorists Owen, Fourier, and Godin, who all attempted to design communities on a collective basis, attempting to promote a strong "sense of community"

(Benevelo, 1971). In the 1950s, '60s, and '70s, these theories were abandoned in mainstream planning and many non-spatial communities, particularly in urban areas, were destroyed in the name of progress. As a result of these actions, a number of theorists (Jacobs, 1961 and Gans 1962) reacted against the popular planning trends at the time and fought vigorously for designers to acknowledge the social aspects of physical design.

For sociologists, on the other hand, the term community has more to do with non-spatial relationships, than with a specific place. Schiefloe (1990) cites Robert A. Nisbet's definition as a viable definition of community:

> ...(community)...encompasses all forms of relationship which are characterized by a high degree of personal intimacy, emotional depth, moral commitment, social cohesion, and continuity in time. Community is founded on man conceived in his wholeness...(Nisbet, 1979: 47)

The noted American sociologist Herbert Gans (1962) applies the term community in both a spatial and social sense. According to Gans, a community exists when a group occupies a common area and participates in similar activities. Within this context, the word *community* expands beyond the physical boundaries and places influence on the social relationship amongst a group of people.

The main point of Gans and other writers is that "community" consists of a group of like-minded people sharing similar interests. I employ the term *community* to include a group of people who reside in a common area and possess the common interest of living in an ecologically compatible manner with the land. I will argue that ecology and community are inextricably linked. Furthermore, I believe at the community level ecological protection is most effective because the environment is no longer an abstract concept, but directly involves the inhabitants and their actions. Therefore, I find this definition of community appropriate for a study on ecology and community design.

2.3 "Anti-Ecological" Communities

In order to present an argument for an alternative approach to community design, I will contrast ecological with conventional community design. The primary problem with conventional communities is that the designs rely on linear systems that are incompatible with cyclic natural systems. In nature, linear systems rarely exist because they exhaust themselves into extinction (Hawkens, 1993). Conventional communities take from natural systems at an unprecedented rate, but put nothing beneficial back in return. Suburban development is perhaps the epitome of conventional community design; one that society has so readily accepted as an ideal solution to community design. In 1989 the single-detached house represented 58% of all new dwelling construction (Statistics Canada, 1989). Many community designers now apply the principles of suburban development designers in urban and rural areas. Like suburbia, rural and urban areas are becoming auto-dependent, less dense, and adopting segregated land uses, all of which are common in conventional communities.

While Girardet (1993) argues that ecological communities maintain a circular metabolism, he asserts that conventional communities have a linear metabolism (Fig. 2.2). He claims:

> ...a community with a linear metabolism takes what it needs from a vast area, with no thought for the consequences, and throws away the remains. Input is unrelated to the output. Nutrients are removed from the land as food is grown, never to be returned. Timber is felled for building purposes or pulp without reforestation occurring. Raw materials are extracted, combined, processed into consumer goods, resulting in rubbish that cannot be beneficially reabsorbed into nature. Fossil fuels are mined in unprecedented quantities or pumped out from the rock strata and redefined, burned, and released into the atmosphere. In sum, our present urban industrial civilization is accelerating environmental destruction with, as yet, hardly imagined consequences for the future of life on the planet (1993: 23).

This linear metabolism is the result of mechanistic thinking. Engwicht (1993) suggests that linear thinking leads to mono-functional and mono-dimensional design solutions based upon generalizations, and proceeds linearly toward deduction. Contrary to this approach, Engwicht proposes that designers switch to eco-rational thinking, which is characteristic of dynamic, intuitive, and specific to each and every situation. Eco-rational thinking is based upon circular thinking, where a designer often uses varied problem-solving techniques to find a design solution. After all, complex problems, more often than not, require complex solutions, so arguably a mechanistic approach to design solution refuses to acknowledge the diversity of ecology and community design.

Linear Metabolism — Anti-Ecological Communities

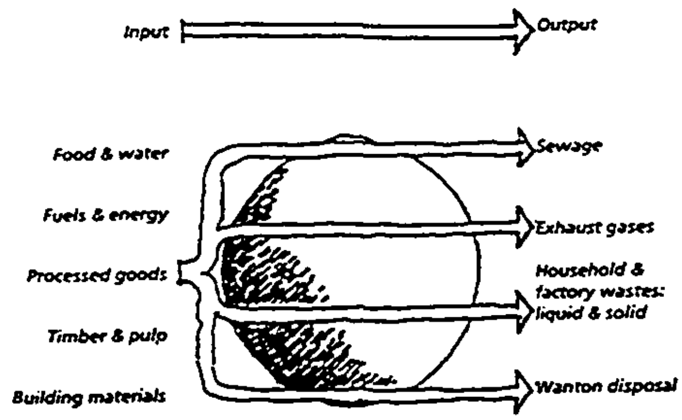


Figure 2.2: A conceptual diagram of a community with a linear metabolism (Adapted from Girardet, 1992)

Many designers from the past advocated and employed this reductionalist thinking. Le Corbusier's concept of the built environment as "machines for the living" has produced a whole generation of mainstream designers who have created communities based solely on functions, form, and simplicity that lead to other deeper and subtler changes in our society. At present, the functions and forms of conventional communities are inefficient. Rob Krier (1987) argues that modern planning fails because communities have become a composition of distinctly separate elements concerning functional zoning and single-use practices. Work is separated from home, commercial from residential, and green space from the entire community. Krier uses the term *anti-ecological*, insinuating that form and function of modern communities cause people to waste time, energy, and land; unlike the efficiencies of natural ecosystems. In this context, modern communities and the land they occupy are ecosystems in deterioration.

Many environmental problems are the result of mechanistic infrastructure provisions for energy supply, water supply, sewage disposal, transport provisions, and building designs. These conventional design solutions require us to rethink the present state of community design, since many of these practices were developed at a time when designers were unaware of the full extent of their decisions; we now know current design practices are directly linked to the destruction of the environment. In the following sections, I will cite specific examples and make a case for the adaption of ecological community planning to replace out-dated design solutions and traditions.

Undefined Community Growth

In the last century, Canada's population has increased from less than two million people to nearly thirty million (Richardson, 1993). Most of the housing for this surge in population consists of suburbs built on the fringe of urban areas as the result of postwar planning and zoning ordinances prepared at a time when land was thought to be unlimited. These suburbs have very low densities and are composed of large single-detached houses, causing an inefficient use of land. In addition, the automobile has made it possible for people to live greater distances from their place of work. These factors have created an almost continual growth or "urban sprawl", with the modern city extending far into the countryside.

The single-detached home places an immense strain on energy and the natural environment. Recent literature (Sewell, 1991 and Calthorpe, 1993) conclude that the single-detached house consumes more energy than any other type of common residential dwelling, especially in Canada where a tremendous amount of energy is consumed during our long, cold winter months. These densities require communities to spend large amounts of money and energy for snow removal in the winter, and, in the summer, for air conditioning, mowing of lawns, and irrigating these lawns (which places a strain on water supplies). These low-density developments require a disproportionate amount of infrastructure to serve so few people, thus reducing any opportunity for affordable housing without subsidies. As a result, costs are deferred to the taxpayer, consumer, businesses, and the environment. Many of these costs are externalities that have an impact on the environment, but are difficult to calculate.

Agriculturalists and environmentalists are the two most vocal groups arguing against continual sprawl, fearing that growth will continue to consume large tracts of land that would otherwise be conserved as productive farmland or habitat (Sewell, 1991). In Ontario, for instance, most of the urbanisation takes places in some of the country's most fertile soils and productive farmland (Richardson, 1993). Yeates (1985) indicates that when urbanization comes increasingly closer to agricultural lands, taxes usually increase. Sprawl sometimes displaces farmers because the increased taxation is beyond their means. Meanwhile, developers and land speculators continue to acquire vast amounts of farmland. All of these situations eventually will directly or indirectly force a demise of agriculturally and environmentally precious lands.

In recognition of recent trends and public concerns regarding urban sprawl, there arises an obvious need to change our patterns of urbanization in order to conserve valuable farmland. The complex issues concerning urban sprawl have, as Richardson states (1993: 159), "...not yet brought about any general recognition that it constitutes one of Canada's principal environmental issues". Even though the environmental effects of urban sprawl are not immediately obvious, architects, planners, and other designers must advocate more efficient use of land, and make more ecologically informed decisions regarding land use. Without a change in behaviour, lateral growth and all of its attached problems will continue.

Auto-Dependent Communities

Without question, the most dominant agent of ecological deterioration and urban form is the automobile (Register, 1987). Conventional communities are designed essentially for the automobile, as opposed to catering to the pedestrian or cyclist. According to David Engwicht, author of *Reclaiming Our Cities and Towns: Better Living with Less Traffic* (1993), automobiles are the primary reason for the decline of community life. He notes that streets once dominated by pedestrians are now noisy, deafening, polluted, and, in some places, unbearable for walking. Architects and planners, however, have been warned about the effects of the automobile in the past. Almost 30 years before Engwicht's writing, prominent planning theorist Lewis Mumford warned:

> ...the archetypal industrial town nevertheless left deep wounds on the environment; and some of its worst features have remained in existence, only superficially improved by neotechnic terms. Thus the automobile has been polluting the air for more than half a century without engineers making any serious effort to remove the highly toxic carbon monoxide gas from its exhaust, though a few breaths of it in pure form are fatal; nor have they eliminated the unburned hydrocarbons which help produce the smog blankets such as motor-ridden conurbation as Los Angeles. So, too, have the transportation and highway engineers who have recklessly driven their multiple-laned expressways into the heart of the city and have provided for mass parking lots and garages to store cars, have masterly repeated and enlarged the worst errors of the railroad engineers. Indeed, at the very moment the elevated railroad for public transportation was being eliminated as a grave nuisance, the forgetful engineers re-

installed the same kind of obsolete structures for the convenience of the private automobile" (Mumford 1961: 479).

This progressive thinking on the part of Mumford is now only beginning to emerge in mainstream architecture and planning. In an issue of *Progressive Architecture* devoted to "Sustainability", many of the prominent architects interviewed argue that the greatest thing that architects can do for the environment "is to promote zoning, planning, and architecture that gets people out of their cars" (Alden-Branch 1993: 74). Realistically speaking, people are so dependent upon their cars that the car is here to stay; however, if designers create communities that foster a greater opportunity of choice in transportation, particularly public, then perhaps society will be one step closer to becoming ecologically responsible.

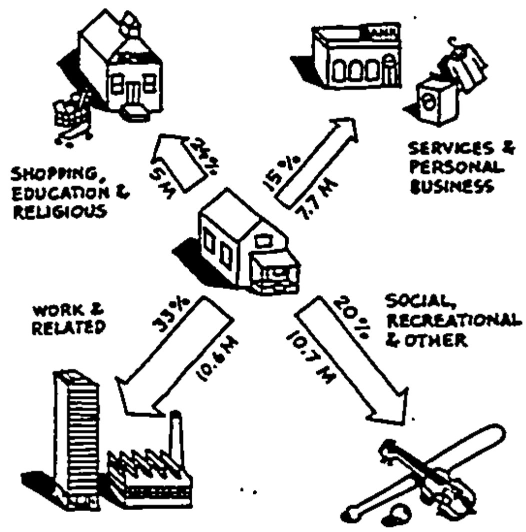


Figure 2.3: A diagram showing the percentage of total household trips which group of activities represents and the average distance travelled for each (From Van der Ryn and Calthorpe, 1986)

The problem of the automobile is not only emissions, but the amount of space devoted to it. When compared with nature's internal efficiencies, automobile transportation systems are spatially inefficient. Engwicht (1993) uses the example of the human body's highly efficient movement system (blood vessel and blood) that takes up just 5% of the body's volume. In the United States, however, more land is devoted to the automobile than to housing, with approximately 2% of the country being covered in asphalt (Brandum, 1994c). Since the automobile allows for almost complete freedom of movement in short time periods, pristine landscapes become more and more susceptible to disruption as a result of new road construction. In fact, today in the United States all land is within thirty miles of a road (Wilson, 1991).

Beyond the well-documented ecological effects, cars produce indirect and immeasurable changes. Engwicht (1993) argues that cars have forced planners to change the function of communities and streets, without knowing the full extent of their actions. He suggests that contemporary community designs have changed the function of space to what he calls "exchange space" (social interaction, marketing, and walking) for "movement space" given over to car, roads, and parking lots, not to mention the loss of park and green space for socialization. Community design is now about controlling movement, the creation of spaces not for people, but for cars. Conducting daily life in most communities is almost impossible without an automobile.

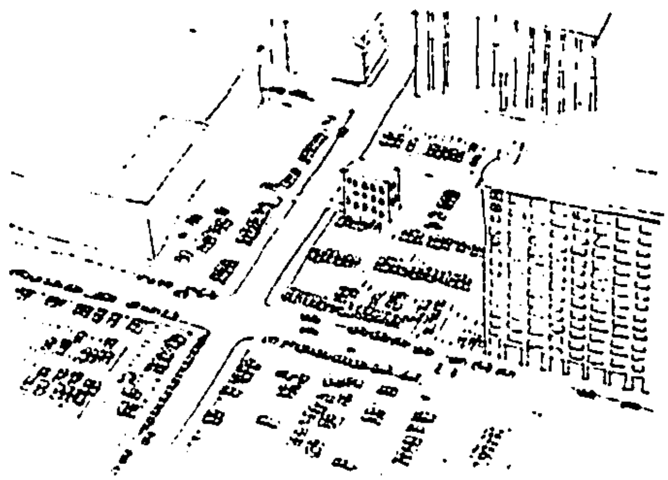


Figure 2.4: A typical situation showing the amount of space consumed for the automobile (From Engwicht, 1993)

Communities Divorced from Nature

According to David Gordon in *Green Cities: Ecological Sound Approaches to Urban Space* (1990: 2), the fundamental consequence of conventional development is "increasing alienation between mankind and the natural world". Human settlements ignore the importance of natural processes and, as a result, people often have little contact with the natural environment in and around the places they live. Hough (1990: 19) argues that "the perception of the city as separate from natural processes that support life has long been a central problem in environmental thinking".

The destruction of the natural environment can also impoverish future generations. The scarcity of nature within human settlements lessens people's perception and appreciation of the environment. When city children believe that vegetables are only bought at the supermarket, that our water only comes from the tap and vanishes into the drain, that garbage is only put into a pail and never seen again, then perhaps there is a great possibility that future generations will have no understanding of the importance of the natural environment. Today it has been reported that adults can recognize more than one thousand brand names, but fewer than ten local plants (Hawkens, 1994). The consequences of the lack of environmental understanding lead to a loss of sensual perceptions, loss of orientation and loss of identification (Hahn and Simonis, 1991). Additionally, this lack of understanding of natural environments contributes to a lack of appreciation because we cannot miss what we never really knew (Register, 1987).

Since natural environments are generally outside the community, they often are only abstractly understood because people rarely experience nature. The person who enjoys the natural environment must often travel long distances to enjoy a piece of nature. As well, only the adult population own cars, depriving 1/3 of the population of access to many natural settings. For the environmentalist the distance travelled defeats their concern for the environment since the travel expends energy produced from fossil fuels. Thus a paradox exists.

Biologically Sterile Landscapes

The reductionist thinking brought forth in the modern era of community planning has diffused into the profession of landscape design. Designed landscapes, in the words of Robert Thayer (1989: 102), "either give token service to environmental stewardship values, or ignore them altogether". These landscapes often are reduced to only a few variety of plants, eliminating the potential for diversity, whereas natural ecosystems consist of a much larger and more complex biological diversity. Hough (1994) indicates that even when compared with a vacant lot, a landscaped residential lot or a city park with lawns has far less floral and faunal diversity. These human-made landscapes need an abundance of energy, water, and chemical fertilizers and pesticides to survive. The lawn is a good example of an artificial landscape expending energy from and suppressing natural environments. Lawns need constant maintenance and attention. Mowing the lawn for half an hour with a gas-powered lawn equals the amount of pollution produced from driving a car 265 kilometres (Brandum, 1994b). It is a simplified ecosystem with little or no value to animals and the natural environment. Alexander Wilson, author of *The Culture of Nature*, comments on the state of modern landscape:

> This simplification of the ecosystem has led to both increased susceptibility to pathogens and a consequent dependence on pesticides. It is a development that is structurally integrated with modern agriculture, and industrial process that depends on abundant and temporarily cheap petroleum and triggers a downward spiral of genetic simplification, pesticide resistance, poor nutrition and health, habitat destruction, and species extinction. To a whole new profession of landscape contractors and maintenance companies, meanwhile, horticulture has become an adjunct of housecleaning; and landscape design an endlessly repeated exercise that bears little relationship to its own bioregion (1991: 106-7).

Since modern landscapes have no relation to their own bioregion, communities are dominated by a landscape resembling what Hough (1984), Wilson (1991) and others refer to as landscapes that are indistinguishable from one region to the next. This standardisation concerns aesthetics and pays little attention to the ecological significance of a diverse landscape. Instead of recognizing the benefits of a diverse and natural landscape, mainstream landscape professions advocate only a small number of plants to endure urban conditions. These designs commonly consist of only 10-15 plant varieties, and, for the most part, these plants are non-indigenous or exotic. In the past nurseries would offer upward to eighty species, many of them native, while today they may only offer ten, most of them exotic (Wilson, 1991). The result is a landscape with no unique identity. The non-indigenous species are an imposition upon their surroundings because they often take more from the natural environment than they are able to give in return.

Wasteful Communities

Consumption levels in Canadian communities are excessively high and waste disposal methods inefficient. Typically, communities transport waste to overflowing landfills that are continuing to grow at an unprecedented rate. The attitude of "out sight, out of mind" prevails, and works against an immediate solution to the solid waste problem. By 1995 all existing landfills in Canada are expected to be full (NRTEE, 1994), and as population grows so will the need for more landfill space if we continue to dispose at current rates. There are simply not enough basic resources to sustain huge populations—our consumptive days must come to an end (Berg 1991).

Many community designers, and the members of the community, do not work towards finding innovations for the waste problem and the inefficiencies created by existing waste handling systems; this lack of concern leads to immense environmental repercussions. The transportation of waste creates pollutants, and is expensive. Some of the more apparent problems with landfills are the loss of farmland, forests, and other valuable habitats as communities turn them into landfill sites. These losses we immediately notice, but other destruction, which may not be easily perceived, is much more threatening. Landfills often release leachate into ground water and, consequently, community water supplies. Raw materials that could be recovered are disposed and cannot be replaced. Waste appears in other forms when communities incinerate garbage and release pollutants into the air and eventually back into the food chain. The bottom line is that landfills and incineration do not solve the problems of waste management; they take the problem from one place and bring it to another; which is not a solution to our disposal needs and does not address the patterns of consumption that produce these wastes.

Water Consumptive Communities

The poor management of water in Canadian communities is a prime example of our wastefulness. In 1991, the average Canadian used 340 litres of water per day at home—an increase of 7% since 1983—making Canada the second largest water user in the world (NRTEE, 1994). Some may argue that such high consumption can be explained by low user rate cost and social attitudes, but generally the design of our buildings does not incorporate water conservation. Half the water we use per day (170 litres) is flushed away in toilets (approximately 20 litres per flush), while other countries such as Germany use only nine litres per flush, and toilets in Scandinavia only use as little as six litres (D'Amour, 1993). Persistent overconsumption depletes a water resource that cannot always be returned to its original quality.

The treatment of water in and around our communities is equally wasteful. Rain runs from roofs of our buildings, streets, and lawns directly into sewage systems by way of storm drains (Fig. 2.5). In an attempt to illustrate how much water communities waste, American eco-architect Malcolm Wells calculated that the City of Philadelphia receives as much rain annually as its total piped water demand, but uses none of it (Pearson, 1989). This approach disrupts the natural hydrologic cycle—the process by which rainwater collects on the ground, infiltrates into the earth to replenish ground water and natural waterways, then evaporates to form clouds, which continue the cycle. When urban runoff does not enter the natural hydrologic cycle, it is unfiltered and contains a high concentration of pollutants harmful to sensitive ecosystems.

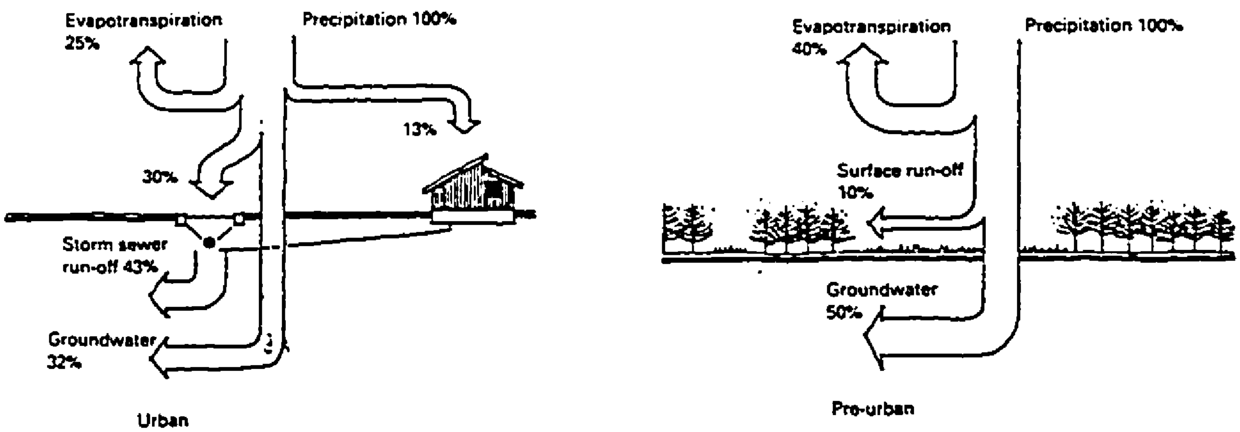


Figure 2.5: Hydrological changes resulting from development (From Ministry of the Environment, Ontario, 1979 in Hough, 1984)

Contaminated urban runoff contributes to the persistent destruction of many valuable habitats near built environments. Tourbier (1988) estimates that 50% of the water that falls onto undisturbed land infiltrates or percolates into the soil. But in developed areas, water that would have entered the natural hydrologic cycle runs off paved surfaces and is discarded in storm drains. Tourbier notes several detrimental effects when runoff is not treated naturally. First, streams cannot accommodate the increase of flows, and widen themselves by eroding their banks. Second, during construction runoff washes away valuable nutrients and causes water pollution, leaving the soil unfertile. Third, at the beginning of a rainstorm, water flushes away contaminants from paved surfaces that have collected for weeks. Tourbier warns that this runoff can be as potent as raw sewage.

As well as being wasteful, traditional stormwater infrastructure is dysfunctional. Often excess and diverted rainfall overloads sewage treatment plants, displacing raw sewage into natural watercourses. These inefficiencies and excess consumption bring about a number cost factors for communities in the form of maintenance and construction. In 1991, one in every five Canadian municipalities with water systems reported problems with water availability (NRTEE, 1994). In light of these economic and environmental problems, the wastefulness and inefficiency of water management clearly shows the illogical manner in which our buildings and communities function.

Communities with Inefficient Sewage Treatment

Conventional sewage treatment plants in many communities represent a classical scientific mechanical solution to a biological "problem". Sewage was traditionally considered as a valuable resource for regeneration of agricultural soils. In many countries, such as China, for example, sewage is responsibly placed back into nature. Conventional systems, however, transport waste quickly though an elaborate, expensive, and energy intensive process, sometimes only to dispose raw sewage dangerously into a natural system.

Conventional sewage treatments are inefficient, both in terms of ecology and economics. For example, the City of Toronto devotes 26% of its total energy operating demand budget to sewage treatment, including the energy component of transportation waste, treating it, incinerating the sludge etc., not including the amount of energy expended to make the cement and pipes for these large systems (Brandum, 1994b). These systems require an extraordinary amount of water to operate, as they were designed when our society believed that resources such as water were infinite. Girardet (1993) notes that conventional sewage disposal systems require one million litres of water to transport only 200 litres of waste.

With conventional systems, one can easily argue that the cost will continue to rise in correspondence with population increase. First, many of these conventional treatment centres are now obsolete and unable to deal with increasing loads, possibly leading to contamination of ground water supplies. Second, construction of new facilities as well as the expansion of existing systems demands large amounts of capital, land, energy, and resources. The existing system has us locked into an abysmal route to economic and ecological deterioration, without any regard for the future consequences. Conventional responses to sewage treatment deplete resources, create waste and pollute. And, of interest to the taxpayer, conventional sewage treatment systems are exceedingly expensive. Without knowing about alternatives, the public has been convinced they must pay the tremendous costs.

Disintegration of Community

Along with the physical aspects, the social aspects of community planning have been vigorously criticized. Researchers have successfully argued that conventional community planning is based entirely on private rather than common values and contributes to a disintegration of community (Franck, 1989; Hayden, 1984; Popenoe, 1988; and Calthorpe 1993). The premise of these arguments implies that mono-functional zoning reinforces social segregation; zoning laws force the separation of age groups, income groups, ethnic groups as well as families through the separation of home and work places (Calthorpe, 1993). Thus, they are communities of isolation, rather than diverse communities that reinforce the public domain.

As a consequence of isolation, conventional communities deter social networks. There are few places where people can socialize when large areas are devoted solely to residential uses, discouraging other mixed uses. Traditional public spaces such as the commons are increasingly displaced for private or semi-private meeting places: shopping malls, private clubs, and gated communities (Calthope, 1993). Cafés, pubs, restaurants and other traditional gathering spaces are seldom present. Sewell (1991) notes that even if conventional communities possessed these gathering places, residents would use cars to drive to them. Consequently, opportunities for social interaction only present themselves in formal settings such as church, schools, and other organized events.

The functional segregation of the modern community has negative consequences for women, children and teenagers. Franck (1989) suggests that the separation of work from residents prohibits children from learning from their parents' profession. The experiences gained from parents' profession have no chance of being passed along to future generations, and valuable skills and information are lost. Furthermore, the commuting time to work takes away time that parents and children could spend socializing. Popenoe (1987) argues that teenagers are dependent upon their parents for mobility. Hayden (1984) criticizes modern community design for neglecting the concerns of women. She claims conventional communities and single-detached homes were designed under the traditional misconception that women stay at home, while the home was a retreat for men after completing a work day in the business district. The designs do not parallel contemporary lifestyles, and undermine women. Thus, community designers and policy-makers establish scenarios that all too often neglect the values of women, children, and teenagers. As result, the community suppresses and fractures social life.

Chapter Summary and Conclusions

This chapter highlighted the environmental and social deterioration that directly result from conventional design solutions based upon linear thinking as opposed to cyclical thinking, or what Engwicht (1993) calls eco-rational thinking modelled after the ecosystems. Conventional design solutions cause communities to take from beyond their bioregions, waste energy, pollute, and constantly deplete the natural environment. Although this chapter paints a bleak picture, the following chapter argues that ecological communities may provide the means through which we may evade serious ecological consequences.

It is possible to convert to community design practices that emulate the cyclical efficiency of natural systems. In the next chapter I outline some principles for ecological communities, which can have transformative effects on the way communities function and maintain their metabolism. For clarity of discussion, I divide the principles into the following five categories: 1) Alternative Energy Systems; 2) Wastewater Treatment and Sewage Reclamation; 3) Waste Management; 4) Ecologically Sustainable Landscapes; and 5) Environmentally Responsible Housing. These principles are meant to create a balance between the inputs and outputs of energy and waste of the community's metabolism.

By applying these principles, community designers can reverse current destructive trends and begin to design in accordance with natural systems. Rather than depleting non-renewable resources, designers can develop systems and design solutions based upon renewable energy and recycled materials and water. Rather than creating biologically sterile landscapes and destroying nature within the communities, a designer can utilize native plants, protect natural areas, and restore habitats. Rather than witnessing the destruction of community, designers and residents can take local initiatives to improve the environment, thus providing a sense of belonging and empowerment.

3

Guiding Principles of Ecological Communities

Introduction

The purpose of this chapter is to familiarize the reader with the central principles of ecological community design. This chapter presents a number of ecologically oriented community design practices, advanced technologies and holistic development alternatives. It explores the manner in which they may be compared with conventional design practices. Finally, the chapter analyses the principles objectively in terms of social, financial, and ecological strengths and weaknesses.

In the process of researching the features of ecological communities, it has become evident that a common thread ties the theories and practices together. These communities all replicate an ecosystem approach to human settlement; they function by making full use of limited resources and producing little waste. The following principles can be applied to the ways designers improve the efficiency of communities, for these individual decisions regarding choice of materials and processes ultimately dictate the impact on the environment. Given appropriate choices, designers can consciously utilize technologies and processes to conserve a community's ecological integrity.

3.1 Alternative Energy Systems at the Community-Scale

A major goal of ecological communities is to raise the energy efficiency of the community and switch to renewable energy systems to reduce the demand for non-renewable energy. Alternative energy systems have less widespread environmental problems than non-renewable energy sources. Non-renewable energy systems rely on destructive mining techniques, expensive transportation systems, and large amounts of energy. In some instances they dam large water bodies. Alternatively, renewable energy systems do not produce emissions, discard pollutants, or exploit natural resources.

Solar Energy

One renewable energy source that can be seriously considered as an alternative to conventionally produced energy is solar energy. In 1980, the Canadian Department of Environment estimated that passive solar energy for space and water heating contributed 1.5% of Canada's primary energy supply. It is predicted to account for 8-9% of by the year 2000 (Eaton et al, 1985). Due to the increase in popularity and technical advancement of solar energy, the cost of photovoltaic equipment has fallen from around $500-600 per peak watt to $5 and it is estimated that it will decrease to the $1-2 level, making it comparable to conventionally produced electricity (WCED, 1987). Observing these trends, one can safely assume that solar energy is a viable alternative source of energy for our country.

For a number of reasons, the benefits of solar energy are quite promising. First of all, solar energy is one of the most environmentally benign sources of energy currently available. By transferring to solar energy, communities can contribute to decreasing the amount of oil-dependent and/or non-renewable energy resources we consume. Second, if houses and commercial buildings develop advanced technologies, it is conceivable that excess electricity produced could be sold to the local municipality, thus making the household a net revenue producer (D'Amour, 1990). The possibilities exist to reduce costs, since water heating is the second largest energy cost in the Canadian household (Brandum, 1994a) Finally, the decentralization of electricity could make for more diverse and self-reliant communities, since solar energy brings the energy source closer to its final destination, and can produce local spin-off employment opportunities.

Even though the potential for solar energy has its positive aspects, in areas where this technology has been applied there have been some minor problems. For instance the World

Commission on Environment and Development (1987) has pointed to the fact that there is an inconvenience of glare produced from the reflection of light off of solar panels. There is not a high demand for solar technology, therefore business avoids exploring the viability of the product.

Combined Heat and Power Schemes

Combined heat and power (CHP) refers to a system where heat from one source of energy is tapped and distributed to housing units for heating purposes. The concept is environmentally benign because, by using waste heat, a community can acquire an adequate amount of energy without using as much energy as conventional heating systems do. In some cases heat energy is obtained from refuse incineration, which can reduce the amount of waste leaving a community. Scientists, however, are still debating the environmental efficiency of burning garbage and are concerned whether the technology can produce toxic emissions. In other cases CHP systems divert steam from steam turbines to heat water, which is piped to houses or industries to create a larger scale heating system.

According to Nijkamp and Perrels (1993) there are two main arguments for CHPs. First, the systems provide a high quality and reliable source of energy. Second, the systems allow owners optimal control of the environmental impacts of energy sources because the system is local and doesn't require the mass amount of infrastructure needed to produce electricity. For Europeans, there is a third reason to switch to CHPs: the European Community plans to enact a law making it illegal to discharge waste heat from power stations (Green, 1991 in Rydin, 1992)

In concept, CHP schemes are an alternative source of energy. However, as with any new concept, there are barriers to its success. Many still argue that this energy source is not entirely renewable. Rydin (1992) considers the key issue to be the viability of such schemes. In each case this depends on discount rates, real fuel-price trends, dwelling density and land-use mix. First of all, the CHP plant has to be close to the community. Second, the cost of building the necessary infrastructure means that the dwelling density has to be high in order to support the project. Rydin calls for the establishment of an urban network that will reduce the initial cost of installing service mains; in time an extension into surrounding suburban areas may be viable.

In addition to these barriers, Nijkamp and Perrels (1993) suggest that the central problem is not technical but social. That is, there are numerous economical, organizational, and political obstacles to the implementation of district heating. In many countries, for instance, existing centralized structure of electricity supply will impede the adoption of district heating schemes. Because CHP systems are often operated on a municipal level, it is not in the best interest of the national energy companies to cooperate. Moreover, in existing neighbourhoods the national energy companies have already laid energy networks that would depreciate in value. Considering these barriers, Nijkamp and Perrels recommend that the introduction of district heating systems has far better opportunities in new residential areas, or in older residential areas that are to be reconstructed.

Certainly there is a capital-intensive barrier to district heating, but the long-term benefits point towards a decline in energy cost. According to Rudig (1986) there is a long- term savings potential of 26.34 to 38.87 mtoe (megaton oil equivalent) per year in the European Community as a whole.

Wind Generated Electricity

Wind power is becoming an increasingly popular alternative source of energy because it has little environmental impact and can take the place of less desirable, non-renewable sources of energy. A 1981 report by the Special Committee on Alternative Energy and Oil Substitution for the Canadian Department of Supply and Services stated that wind power is a clean source of energy and could be considered as an alternative to fossil fuels; but the report also noted that problems include noise, aesthetics, and interference with communication signals.

In spite of the fact that wind power has some problems, some states such as California have built wind-generating plants on large tracts of farmland where the use of wind power is much more practical than acquiring power from the conventional electricity grid (Fig. 3.1). In some cases, farmers in windy areas of California have been able to capitalize on this opportunity by selling the electricity produced, or the rights to the land utilized. In light of their advancements, the cost of each wind generator has been lowered to $100,000 (U.S.), which has made wind-generated electricity cheaper than electricity produced by coal-fired plants (Girardet, 1993).

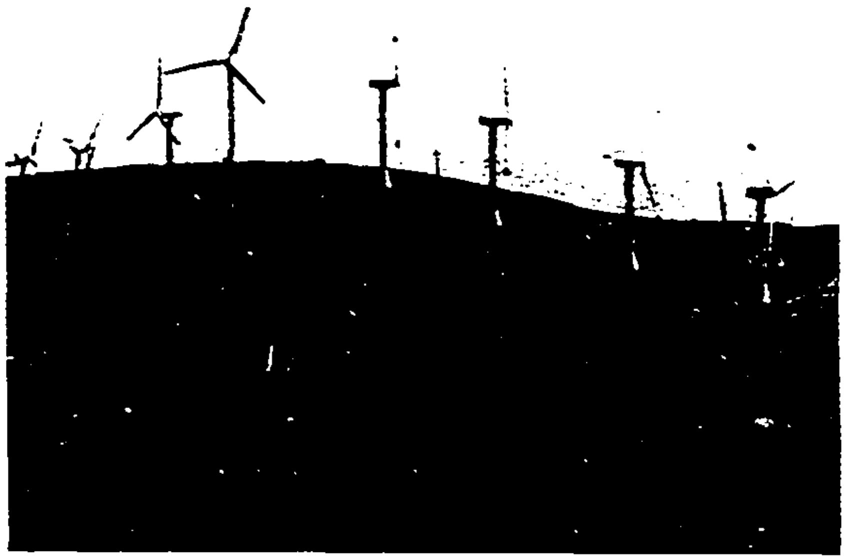


Figure 3.1: Wind Turbine Array At a capacity equivalent to a nuclear station it will create only a quarter of the carbon dioxide pollution. (From Vale & Vale 1991)

Certainly there is a tremendous potential for Canadians to benefit from wind power, since a large amount of our country meets the criteria for establishing wind-generation plants. In fact, Canada has the ability to produce as much as 20% of its current consumption level by wind power (Girardet, 1993), especially in Atlantic Canada where the highest average windspeeds occur (Eaton et al, 1985). In areas of the country where conditions are favourable, it is possible that wind power may well be a viable alternative source of electricity, both as a commercial and domestic source.

There is, however, opposition from people in many countries (supported by power corporations) who criticize windmills because they are noisy, visually intrusive, especially when placed in beautiful windswept countryside, leaving some to refer to them as "white satanic mills" (Fairlie, 1994) However, the same argument can be made against electricity pylons, which are visually intrusive, noisy, and disrupt the landscape. Regardless of personal aesthetical preferences, windmills are optimum for remote areas, requiring only a short construction time, and are a renewable sources of energy. Problems result when the government imposes windmills on people. Therefore, for people to be satisfied wind-generated electricity the community must decide for or against windmills as an alternative energy system.

3.2 Wastewater Treatment and Water Reclamation

Sewage Disposal

A logical solution for sewage treatment problems is to start using composting toilets, which produce a byproduct that can be used as garden fertilizer. Before flush toilets became commonplace, farmers used human and animal waste to replenish the land. This is an asset because human and animal waste contains all the essential nutrients for the healthy production of crops. The use of compost toilets can reduce the waste from a dwelling by 40% (Rydin, 1992), as well as reduce pollutants that would otherwise be transported to natural waterways. Compost toilets are now equipped with electrical units that can speed up the normal composting time, rectifying the most common complaint among urban people regarding the slow speed of traditional methods of compost.

In the last twenty years landscape architects and ecologists have been advocating biological wastewater treatment systems in the form of constructed wetlands. In concept the system involves taking sewage from buildings and filtering it through the landscape where plants (eg. reeds and cattails) cleanse the wastewater, treating it to a high level of purification. When compared with water treated by municipal systems, the naturally filtered water is considered pure because municipal systems only filter solids and do not fully treat the wastewater. Critics suggest that the biological forms of treatment rely on larger tracts of land than conventional wastewater systems, and they advocate biological treatment in communities where there is usually more land available.

Even though there are problems, the benefits of biological wastewater treatment outweigh the problems for a number of reasons. First, the system purifies sewage and wastewater without using chemicals. Second, the nutrient-rich byproduct can be used for irrigation in dry seasons. Third, the process replenishes local ground water supplies and waste becomes part of ecological cycles. Fourth, the system provides outdoor spaces for riparian habitat and recreation that in some cases would otherwise be destroyed. Fifth, biological waste water treatment systems create local employment. Sixth, residents can acquire an understanding of natural processes and cycles. The final reason governments find these systems attractive is because they are economical. Researchers estimate that biological wastewater treatment systems cost less than half as much to construct as conventional mechanical treatment systems (Gillette, 1992).

Other systems are emerging as alternatives to conventional sewage treatment. One particularly popular system is "Solar Aquatics" developed by Dr. John Todd of the New Alchemy Institute in Falmouth, Massachusetts. The Body Shop, which operates a solar aquatics system in one of their Toronto factories, has been one of Todd's clients who promote the system. Solar aquatics uses greenhouses to store solar energy to purify waste, and, in some cases, to produce food from plants, all without the use of chemicals.

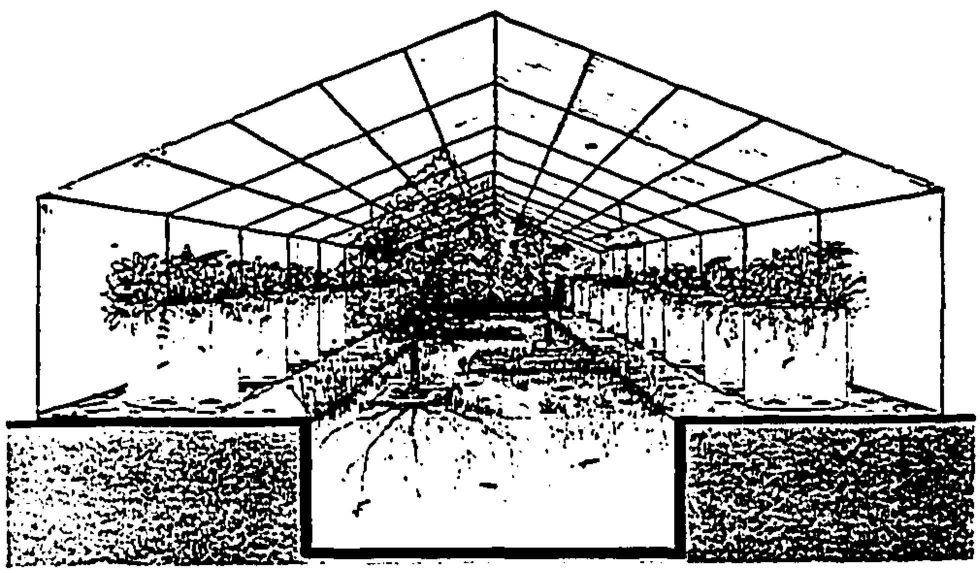


Figure 3.2: Solar Aquatics sewage treatment: greenhouses that produce clean water (©Environmental Design and Management Ltd., 1994).

Most systems treat the waste by way of a four-stage process. The following is summary of the process from Spencer (1990). The first stage consists of series of tanks through which water flows, starting at the top of each tank and leaving via the bottom to enter the top of the next tank. Each tank is equipped with a bubble diffuser aeration system that provides oxygen and reduces odours. Snails and zooplankton feed on the organic waste and keep the walls of the tank clean to allow essential sunlight to enter. Stage two includes an artificial filtering marsh. The marsh serves the same function as the artificial wetlands mentioned previously by treating the wastewater with plants to convert the water to a high level of purification. Stage three provides similar tanks as in stage one, with the addition of fish. Stage four includes more polishing marshes, which are similar to the stage two marshes, only often much smaller. From the fourth stage the wastewater is purified and placed back into the natural environment.

Other alternative building technologies are now available that can create energy from sewage through fermentation or anaerobic digestion, which produces a useable bio-gas for fuel. In some cases, waste is combusted to produce both heat and electricity. Once the human waste is converted to bio-gas, the product can be used as an energy source to heat homes. Recently the Wessex Water Authority in England has used bio-gas from treatment facilities to generate electricity, with a two-year payback period quoted for the capital investment (Rydin, 1992). In short, there are alternatives that move away from the dependence on the "sewage grid infrastructure" and lessen the impact on ecosystems such as lakes, rivers, and streams.

Storm Water Management

A common principle for ecological communities concerns treating storm water naturally. In built environments rainwater has historically been considered "refuse" as opposed to being an "asset". The water that falls onto paved urban sites is rushed from the surface to storm drains. This approach disrupts the natural hydrologic cycle—the process by which rainwater collects on the ground, infiltrates into the earth to replenish ground water and natural waterways, and then evaporates to form clouds, which continue the cycle. When urban runoff does not enter the natural hydrologic cycle, it is unfiltered and contains a high concentration of pollutants harmful to sensitive ecosystems.

Contaminated urban runoff has contributed to the destruction of many valuable habitats near built environments. John Tourbier (1988), has estimated that 50% of the water that falls onto undisturbed land infiltrates, or percolates into the soil. But in developed areas, water that would have entered the natural hydrologic cycle runs off paved surfaces and is discarded in storm drains. Tourbier notes several detrimental effects when runoff is not treated naturally. First, streams cannot accommodate the increase in flows, and widen themselves by eroding their banks. Second, during construction, runoff washes away valuable nutrients from exposed soil, the nutrients cause water pollution and the soil is left unfertile. Third, at the beginning of a rainstorm, water flushes away contaminants from paved and compacted surfaces that have collected for weeks. Tourbier warns that this runoff can be as potent as raw sewage.

In recent years designers have been experimenting with alternative storm drainage techniques. It has been shown that experimentation and adoption of flexible engineering is essential to accommodate development while protecting the natural environment (Yip, 1994). One alternative approach to storm water treatment is to collect it on site and use the water for purposes that do not require high quality water (eg. irrigation and sewage disposal). Water can be collected in artificial storm retention ponds or by open swales, where moulded basins hold storm water during peak flows and let it filter naturally into the soil. When these elements are graded properly, storm retention ponds can become an aesthetically pleasing attribute of a development. In addition, the shallower ponds can be utilized for recreation purpose during dry periods, because recreation spaces are usually not utilized during periods of high rainfall.

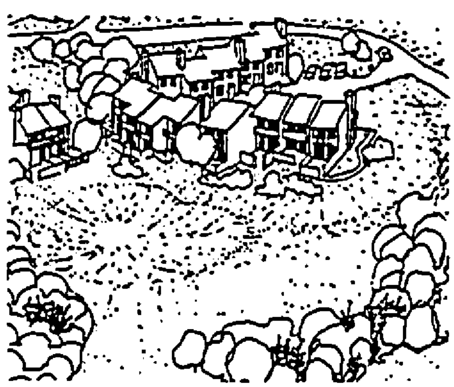


Figure 3.3: A dry stormwater retention basin can reduce harmful runoff while contributing to an attractive design. (from Tourbier, 1988)

Another approach to treating stormwater naturally is to use permeable paving surfaces to allow rainfall to infiltrate directly into the earth, instead of flowing over oil-drenched and impermeable asphalt and concrete surfaces. In addition to permeable pavers, John Tourbier suggests the use of "Dutch Drains", gravel-drained trenches, to allow storm water to infiltrate into the ground. When covered with cobbles or unit pavers, "dutch drains" have been utilized to create attractive patterns in paved surfaces.

Finally there is the option of diverting storm drainage into strips of water-tolerant vegetation. In this situation, the vegetation slows runoff, cleansing pollutants and allowing nutrients to replenish the soil. These filter strips often serve a double purpose by adding to the amount of green space within urban areas. Moreover, these drainage systems allow the public to see the how water functions in nature and gain an understanding of how water naturally flows.

3.3 Waste Management in the Community

To establish a circular metabolism, society must become more accountable for its waste. In the last one hundred years, however, Canada has become both a consumer-oriented society and a "throwaway" society. Canada can now stake the claim as one of the world's largest waste producers, creating nearly two kilograms per person per day (Stren, 1993). In Canada, landfills are shrinking, the cost of waste transportation is expensive, many communities are experiencing ground water contamination, and a number of non-renewable resources are being depleted at an alarming rate. As a result, communities face dramatic economic and environmental repercussions.

Community Recycling

There are two basic ways communities can reduce waste. The first is to decrease the amount of waste entering the solid waste stream by reducing the volume of products entering the community, and increasing the longevity of products. The second is to retrieve wastes after they have been discarded or divert them from the waste stream. For example, glass, plastic, and metal can be collected and reused or converted to other uses. The first solution is preferred because other alternatives require a considerable amount of energy. Overall, the objective of any ecological community waste management programme is to have a waste handling system based on sorting, recycling, and composting

It is only in the last few years that communities have begun to understand the real cost of waste disposal; community recycling in Canada is making progress. In response to waste management, communities have developed recycling programs that involve composting, drop-off points, curb-side pickup, buy-back programs and redemption centres (Van Vliet, 1993). These projects have shown that it is possible to recycle three-quarters of the garbage discarded (Girardet, 1993).

Since the advent of large-scale recycling schemes, some communities have created effective markets for the recycling of their products. At first thought, the idea that money can be made from a product that previously had no monetary value seems to be very attractive. However, as Van Vliet (1993: 186) suggests, "when waste becomes a profitable commodity, the underlying logic implies that there is money to be made by selling and processing garbage". As a result, it is possible that the making-money-from-garbage scenario will actually generate additional waste. From an ecological standpoint, perhaps it is more logical to provide incentives to reduce the production of waste at its primary source.

Community Composting

It is estimated that upwards of 40% of household waste is organic, approximately 13% of the total municipal waste stream (CMHC, 1992). Many communities consider the organic matter to be waste and deposit it in already overflowing landfills. Yet, these organics contain essential nutrients for food production and nutrients for replenishing soils. In the past, communities collected and distributed organic waste to nearby farmers who used the compost for food production. In the late 1880s in Paris, the Russian urbanist Kropotkin wrote of the productivity of the Parisians, who recycled and composted human and animal waste. The waste byproducts were used to fertilize farms on the edge of the city that were only about 860 acres and worked by 5000 people, yet supplied enough fruits and vegetables to feed 2 million people; excess produce was sold to London (Girardet, 1993). This example illustrates how cities and towns can achieve a circular metabolism in regards to the waste they produce, whereby elements entering the system can leave the system as useful byproducts.

In urban areas, however, the food production system is not necessarily compatible with the traditional human settlements. Nonetheless, there are still advantages and modern uses for large-scale composting operations. Some municipalities in Canada have established community composts where large amount of leaves are collected in the fall and then the nutrient-rich compost is available for the soil of newly planted trees in the spring. The final product can also be sold to those gardeners who do not have the opportunity to produce their own compost.

The benefits of a community compost extend far beyond the environmental advantages listed. Practising composting diverts one-third of the community waste going to landfills, which subsequently reduces the energy for trucks and other transport. The community compost can, depending upon its size, produce a variety of jobs. The creation of a community compost can set a precedent for other communities, and provide a good example for the citizens of the community, perhaps instilling a sense of pride. Overall, the community compost symbolises a holistic and responsible approach to large-scale waste management.

3.4 Ecologically Sustainable Landscapes

Naturalized Landscapes

Most contemporary landscapes are not environmentally benign. Designed landscapes commonly require water, fertilizers, herbicides or pesticides. They frequently restrict the potential for flora and faunal species diversity rather than preserving or enhancing it (Hough, 1984). They often separate, rather than enfranchise people (Hester, 1983). In short, ornamental landscapes do not perform many valuable natural functions. Instead, these landscapes are artificial. As well, John Lyle (1993) notes, ornamental landscapes are only a decorative addition and do not become a unifying, integrating network of urban form.

Increasingly, many communities have been converting their ornamental parklands into naturalized landscapes. There are two apparent reasons for this conversion: 1) pressures from environmental groups, and 2) since the recession, many municipalities realize the tremendous cost associated with maintaining manicured landscapes. Natural landscapes are multi-functionary and inexpensive to maintain. A switch to indigenous landscapes creates diverse habitats (Hough, 1993), and collects rainwater and holds it for future use or allows it to infiltrate slowly into groundwater storage (Lyle, 1993). Naturalized landscapes can achieve a long-term regenerative capacity (Thayer, 1989), which makes them both environmentally and economically sustainable.

The aesthetics of a naturalized landscape are, sometimes, quite different from those of a designed landscape. This aesthetic is, perhaps, the central problem regarding the acceptance of naturalized landscapes. For example, our society perceives wetlands and wildflower fields as wasteland, even when they are an essential element of habitat diversity and natural process. In other instances, Michael Hough (1993) agrees that naturalization is beneficial to an urban landscape, but he also admits, "there are many areas where that is the last thing one wants to do".

Community Farming

Food production in urban areas was displaced early in this century to far beyond the urban fringe because 1) transportation costs decreased and 2) urban areas expanded and converted agricultural lands to other uses (Girardet, 1993). As a result, the amount of greenspace for farming within the city was reduced. As well, the provision of relatively cheap produce from rural populations provides little incentive for local or part-time farmers to produce food for themselves or markets.

In the last few years, however, there has been a resurgence of urban farming and vegetable gardens as a result of the "green cities" movements. Stokes (1978) indicates that as much as 6% of the food produced in the United States is derived from home gardens (White and Whitney in Stren et al, 1993). Many communities have begun to convert urban empty lots into lush fruit and vegetable gardens for the collective use of the community. These urban farms have produced a variety of fruits and vegetables. In addition, most urban farmers are sympathetic toward the land and are advocates of organic farming. In addition to the environmental benefits, urban gardening provides a meeting place for people of varying ages, races, and backgrounds.

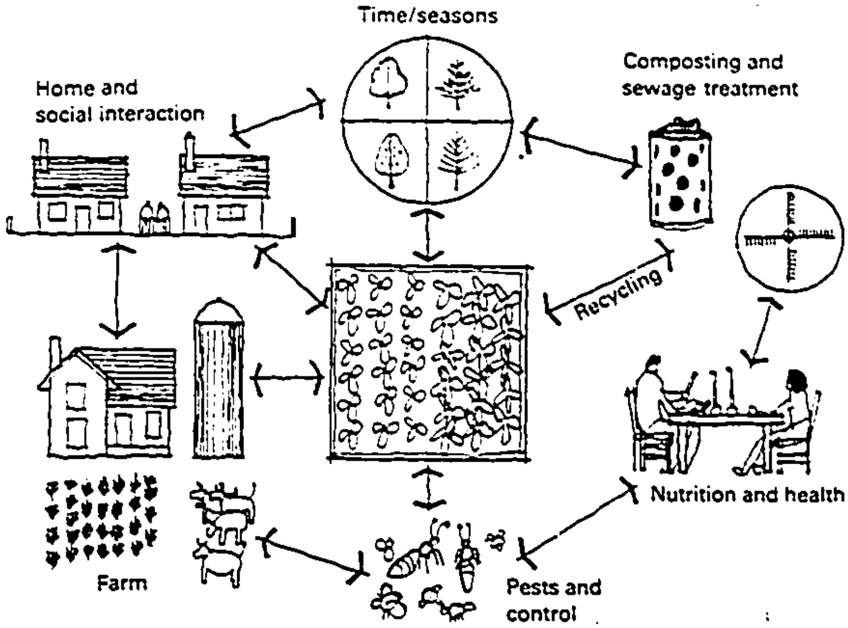


Figure 3.4: A diagram showing the social and environmental learning opportunities associated with community farming (from Hough, 1984)

For example, two years ago in Halifax, Nova Scotia, a small group of citizens converted an abandoned lot in the north end of the city into a vegetable garden. At first, the lot was nothing more than wasteland. Within a short period, it had became a lush garden full of vegetables, flowers, and full of neighbours sharing in a common project. People filled their days with the pleasure and satisfaction of gardening. Many suggested they experienced therapeutic and social benefits, not to mention the aesthetic improvement to the neighbourhood. By the end of the summer, many residents experienced a modest harvest, and even shared the vegetables with neighbours. Additionally, Hough (1984) found that community farming heightens community interaction, reduces vandalism, and enhances the physical appearance of the surrounding area (Fig. 3.4).

Some, however, argue against urban farming. Harry Pelissero (1993), past president of the Ontario Federation of Agriculture, suggests that the trend towards urban farming is nothing but a romantic vision of farming. In his article "Urban Agriculture in the Green City", Pelissero argues that farming today is a "highly specialized and capitalized industry", whereby urban farming could take away from the business of farming. In quantitative terms, one would surely agree with Pelissero, but in terms of quality of life, there are benefits to urban farming.

3.5 Environmentally Responsible Housing

Environmentally responsible housing is a term that may include "green architecture", "ecological housing", "sustainable housing". In this study the term is used interchangeably. It refers to housing harmoniously integrated into the natural environment, often contrasting with the principles of conventionally built housing (eg. similar principles found in an anti-ecological community). Although still diverse in design and construction, the literature suggests that environmentally responsible housing shares three main components. First, they all focus on reducing resource consumption through energy efficiency and recycling and reusing building materials. Second, they attempt to reduce their environmental impacts on the natural and built environment by choice and use of materials, and in the way they dispose of construction waste. Designers can choose materials that do not generate pollutants or emissions and can reduce the impacts on the natural environment by employing sensitive site planning techniques. Third, the viability of environmentally responsible housing increases when placed in a community reflecting similar principles. For example, an auto-dependant community would defeat the purpose of an environmentally responsible house since a car in the driveway will be the single most energy consuming device in the household (Brandum, 1994b), not to mention the other environmental problems attached with automobile infrastructure noted earlier. These three components can represent a variety of housing types (eg. passive solar housing, energy efficient housing, or houses made from recycled material). Although, one component may make the house become more environmentally responsible, what is desirable is a combination of the three components. The following explores some of the of environmentally responsible housing emerging in Canada.

State of the Art

In Canada, many designers have begun to incorporate concerns for the environment into the construction of their buildings. These designers have collected more and more practical research over the last two decades that has improved the understanding of environmental issues in the construction and design industry. The Canada Mortgage and Housing Corporation

(CMHC) has also launched several initiatives aimed at encouraging environmentally responsible housing forms. Their most recent and exciting initiative has been the 1991 Healthy Housing Design Competition. There were approximately one-hundred entries, indicating the immense interest in ecological housing. The winner, Martin Liefhebber of Toronto, created a house that is entirely self-efficient, making no use of municipal infrastructure such as sewage, storm, or waste disposal; it even produces its own electricity (Fig. 3.5). Although still in the approval stages, the winning entry is expected to provide an interesting example of environmentally responsible housing.

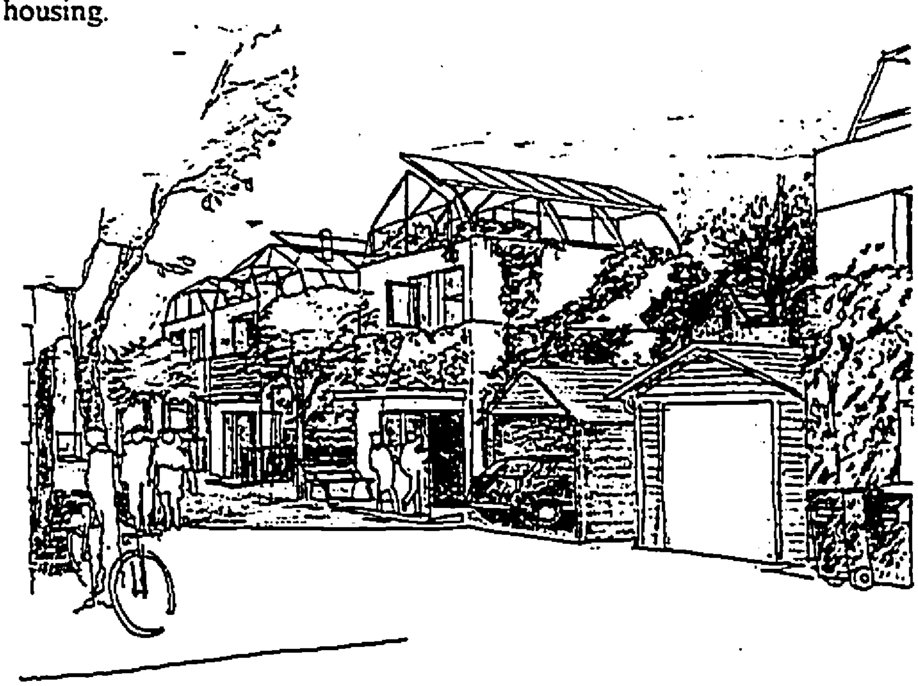


Figure 3.5: Self-Sustaining backyard houses envisioned for Toronto by Martin Liefhebber. (Source: Progressive Architecture, March 1993)

Researchers at McGill University undertake further environmental housing initiatives which contribute to the existing knowledge base in Canada. In 1990, the McGill Affordable Homes program developed a prototype narrow-front town house, the "Grow Home". Due to its low cost and efficient marketing plan, 1000 of these houses were built within one year. However, during the initial design stages, the researchers did not explore the environmental impact of the Grow Home. In 1993, various members of the Affordable Homes program prepared a report entitled "Greening the Grow Home" to investigate an integration of environmental benefits into future construction. The report suggested significant means of creating a healthier environment. The report includes the research of building materials, water efficiency, waste disposal, and water-efficient landscapes. In addition, the report explored many community planning aspects of design such as site planning, vehicular circulation, and outdoor spaces. In short, it provided a document that can assist builders, architects, and planners in promoting more responsible development practice, thus leading towards a more sustainable design option.

Energy-Efficient Housing in Canada

By world standards, Canada has probably built some of the most energy-efficient housing. These advancements came in reaction to cold climate and, in part, as a result of previous lack of interest in energy conservation. In fact, entire nations could thrive on the energy Canada wastes annually from our inefficient buildings (D'Amour, 1990).

In the last two decades governmental agencies have taken on the task of increasing energy-efficiency in residential housing by as much as 50% compared with conventionally built housing. As a result of years of research and development, the Canadian government has utilized this research and developed a prototype called the R-2000 house. The aim of this project is to reduce energy consumption through various performance standards rather than dictating the specific appearance and design of the house. The promoters of the R-2000 have, however, aimed towards creating competitively priced buildings. Today, the R-2000 house is receiving widespread acceptance and is being constructed in all regions of the country.

Comparing R-2000 houses with a conventional houses is quite difficult in terms of appearance. The major differences are in the amount of energy consumed and the energy performance. Some of the innovative features of this prototype include careful sealing against leakage, insulated doors and windows, high levels of insulation, continuous air-vapour barriers, and advanced heating systems. In addition, when site conditions allow, many R-2000 homes take advantage of solar heat and light. Collectively, the features can reduce the impact of energy use on the environment.

As more R-2000 homes are built, the Canadian Department of Energy Mines and Resources along with the Canadian Homes Builders Association have been monitoring the performance standards of R-2000 homes. Continuous monitoring, testing, and improvements lead to a more promising form of residential construction. The success of R-2000 continues, as countries such as Japan have been attempting to adapt R-2000 technologies in their country.

The Implications of Environmentally Responsible Housing

With the advent of many of these environmentally responsible housing initiatives, the built environment may attain more harmony with the natural environment. These advancements are encouraging. We are witnessing a time when innovative ideas are becoming practical and moving away from academic arguments over the viability of environmentally responsible housing. Builders and the public can now visit examples of ecologically responsible housing, and can enquire as to the building practices, or make contributions to future housing projects.

Although there have been many advancements, there still are opportunities for improvement. For instance, the irony is that for the most part these environmentally responsible houses are single-detached buildings located in low-density suburbs far from the owner's place of work. In the larger context, an energy-consuming single detached house defeats the purpose of conserving resources because, as CMHC notes, a low-density community increases the dependence on the automobile, which is responsible for over 13 percent of the total energy consumed in Canada. In recognition of this, there becomes an obvious need for a more comprehensive and integrated approach to design, including both architecture and planning.

Chapter Summary and Conclusions

There are two essential aspect of ecological community design that have purposely been withheld until the end to this chapter because they often overlap and are interdependent upon the preceding five principles: 1) the role of the automobile, and 2) the importance and meaning of community. Without involving the community and dealing with the automobile, the implementation of the principles discussed will have lesser impact.

First, as mentioned in Chapter Two, the automobile is the single largest element in the destruction of the environment and community. Unless we reduce car use, other efforts to conserve the environment will have limited effects. Auto use increases our dependency on fossil fuels. Because of the automobile, land that would otherwise be devoted to parks and naturalized spaces is converted to highways and parking lots. Fewer automobiles would mean that people would walk and take public transport, thus increasing their chances of meeting other community members in spontaneous gatherings. The automobile defeats the purpose of creating environmentally responsible housing since the automobile will consume more energy than any house built in accordance with strict energy-saving measures (Brandum, 1994b).

Communities around the world are experimenting with car-free environments. They attempt to establish communities for pedestrians rather than exclusively for the automobile. This design philosophy has clear and distinct advantages for the citizen, environment, and even the developer. Engwicht (1993) claims that developers would have far greater yield for the land. And residents would have a broader range of services, no traffic noise, clean air and an environment safe from automobile accidents. In Engwicht's perception there is a market of home buyers searching for car-free environments, including people who cannot drive and people who do not want to drive. Furthermore, he is convinced that if there were more of these communities, consumers would demand similar environments or people would enquire how they could reduce traffic in their own communities.

An increasing number of communities are being built for pedestrians first and the automobile second. Doug Kelbaugh, from the Architecture Department at the University of Washington, developed the concept of "Pedestrian Pockets" to promote community plans that reduce auto usage by making communities comfortable for walking. Along the same lines of thinking came a whole new group of community planners advocating the concept of pedestrian pocket. Notably is Peter Calthorpe's community plans based upon pedestrian circularation (Fig 3.6). Calthorpe's designs are not new, but a revisit the works of Leon Krier, Christopher

Alexander, and the theories of Jane Jacobs. Calthorpe fuses the teaching of his predecessors with the realities of contemporary culture. In response to the automobile and as a voice for the pedestrian he argues the following:

> Although pedestrians will not displace the car anytime soon, their absence in our thinking and planning is a fundamental sources of failure in our new developments. To plan as if there were pedestrians may be a self-fulfilling act; it will give kids some autonomy, the elderly basic access, and others the choice to walk again. To plan as if there were pedestrians will turn suburbs into towns, projects into neighbourhoods, and networks into communities. (Calthorpe 1993: 17)

Figure 3.6: Sample plan and sketch form the pedestrian pocket concept that use walkable, mixed used communities to encourage public transport, protect open space, and make compact forms of development (from Calthorpe 1993)

The bicycle is another important aspect of alternative transportation almost completely ignored in conventional community planning, while opportunities exist to easily incorporate bicycle lanes into the planning of traffic systems. But, after roads are designed without provision for the bicycle, traffic systems require a major revamping. The irony is that the bicycle is easily one of the most efficient and environmentally benign transportation technologies ever invented.

The bicycle transforms the community into a place that can be travelled around quietly and accessibly, with safer streets, fewer roads, and less valuable land sacrificed for car parking lots.

The bottom line remains: with fewer automobiles comes less environmental destruction, and consequently more opportunity to build community ties. Streets may once again return to being safe, less noisy, filled with fresh air, and above all alive with movement that is relaxed and enjoyable. Living with fewer automobiles would show community residents what is imaginable in community design.

The second point withheld until the end, which pertains to almost all five principles, concerns the importance of community as absolutely imperative for the development of an alternative design solution. At the community level, people are directly affected by decisions concerning the natural environment (Owen, 1991). Moreover, the actions of a group are often much stronger and more influential than the concerns of one individual, which suggests that strength is in the unity of numbers. Without such strength of community and concern for the local environment, many of the principles of ecological community design would have little influence.

At the community level, people appreciate their local natural environment and have a vested interest in conservation. Thus, the implementation of alternative energy technologies, biological sewage treatment plants and community gardens are inherently connected to the people living in the community. The advantages of the environmental change resulting from the application of these principles are often easier to understand at the community level. There are often fewer impediments at the community level, and since people of a community are often like-minded the chances of success increase. At the community level, people wield time, energy, and money more efficiently, and, depending upon the amount of community involvement, the community can spread responsibilities over a larger area. Finally, the environmental movement has traditionally been grassroots, and advocates that change has to take place on small projects, before any substantial transformations arise.

Obviously, the construction of viable ecological communities demands more than the elements discussed. These principles, however, can be considered as a framework that may initiate change. In more realistic terms, the principles discussed need the coordination of many residents of a community to achieve marginal improvements. In some cases, ecological community design projects involve a unique orchestration of all interested parties, including planners, architects, builders and so on. A collaboration of these parties can produce successful results that can provide precedent for others to advance in this field of design. The following chapter will examine the experiences of several ecological communities in Northern Europe in accordance with the principles of ecological design discussed up to this point.

4

Five Ecological Communities

Introduction

The purpose of researching these case studies is to examine built examples of ecological communities in Northern Europe and to discover what designers can learn from these projects. The concept of ecological community design has only recently been recognised in Canada and, unfortunately, no such communities have been built. In places such as Denmark, Sweden, and Germany, architects and planners have designed and constructed communities with an ecological emphasis. As a result, the practice of ecological design is advancing, and opportunities exist for designers to view real and practical solutions to ecological community design, instead of addressing this topic on a purely theoretical level.

This chapter describes five ecological communities from the research I conducted during the summer of 1994. I discuss each case study in accordance with the principles of ecological community design outlined in Chapter Three (Fig. 4.1). This study does not, however, intend to compare the individual communities, but examines elements that comply with the ecological principles of the community. In the final chapters, however, I will discuss the reasons why some elements are of particular significance to those wishing to create ecological communities in their own situation, particularly the points that present designers with the opportunity to learn more about ecological community design.

Principles of Ecological Communities

Community	Energy			Water		Waste		Landscape		Housing			Transport			
	Solar Energy	CHPs	Wind Power	Biological Sewage Treatment	Natural Drainage	Community Recycling	Community Composting	Naturalized Landscapes	Community Farming	Energy Efficient	Water Efficient	Local Materials	Car-Free Environments	Car-Sharing	Alternate Road Design	Public Transportation
Ecolonia	●	●		●	●	●	●			●	●		○		○	○
Lebensgarten	●	●		●	●	●	●	●	●	●	●	●			○	○
Frasenweg	●				●	●	●	●	●	●	●	●	○		○	○
Vallersund Gård			●		●	●	●	●	●			●		○	○	○
Järna		●		●	●	●	●	●	●	●	●	●	○	○		○

○ *Transport is not a core principle, but is included in the design of ecological communities.*

Figure 4.1: Matrix summarizing the principles fulfilled by each of the five ecological communities.

In the description of each community, I follow a three-part format. First, a general project overview describes the location, size, history, main players, reason for being, and some points pertaining to ecological aspects of each community. The second part describes in detail the ecological principles of each community, all of which I have described in general in Chapter Three. For the sake of brevity, I describe only representative examples of these principles. While all the principles are represented, I do not always discuss them in detail for every community. Third, a final remarks section summarizes some unexpected aspects of these communities. Overall, the descriptions give insight into the practice of ecological community design in an attempt to contribute to discovering what designers can learn from these European ecological communities.

4.1 Ecolonia in Alphen aan der Rijn, The Netherlands

General Overview

Ecolonia (Ecology + Colony) is a small-scale demonstration community of 101 dwellings located within the Kerk en Zonen, a newly developed area of Alphen aan der Rijn, in the south of The Netherlands. With a strong ecological influence, Ecolonia consists of energy-efficient housing built with environmentally responsible materials. The project derives from initiatives of Novem, the Netherlands Company for Energy and the Environment, with assistance from the Dutch Ministry of Economic Affairs and Ministry of Housing, Planning and the Environment. The community was designed in 1989 by the internationally known architect and town planner Lucien Kroll, who allocated nine different architects to develop designs for buildings within Ecolonia.

In opposition to the way communities have been developed over the last fifty years, Kroll attempted to design a community in which the people and then ecology are the priority of the design. In an interview in *The Architectural Review* (March, 1992), Kroll commented that people have gradually been expropriated in the creation of the places where they live. He argues that in mechanistic and formalistic architecture people have been prevented from making decisions about their environment. To Kroll, communities designed as a result of this phenomenon have physical characteristics "which give rise both to personal depression, and to depressing lifeless spaces" (Blundell-Jones 1992: 64).

Layout and Design

In 1989, Kroll designed Ecolonia to reflect his convictions about ecological community planning and to provide an alternative to conventional development practices. Instead of beginning with the road construction, as conventional developments of this size normally proceed, Kroll first designed a large pond in the middle of the community, attached to the dykes of Alphen aan den Rijn (Fig. 4.2). The pond collects all the rainwater from the surrounding dwellings and surfaces via mole drains, then filters the wastewater through aquatic plants before the water enters the dykes. There are roads in the community, but the car is secondary, evident by the traffic layout favouring pedestrians. This particular approach immediately begins to present a much more humane living environment.

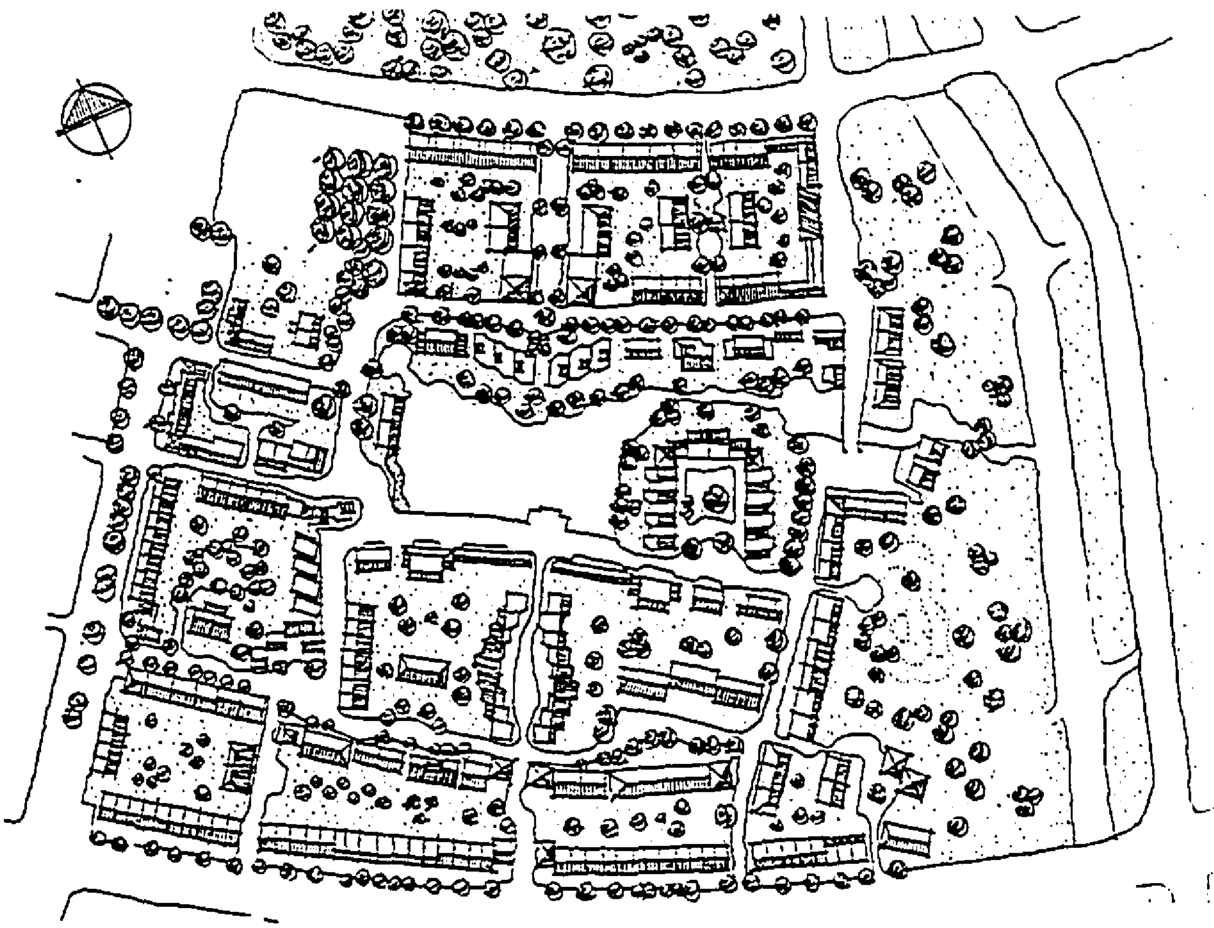


Figure 4.2: Site plan of Ecolonia (adapted from Novem Brochure)

Given that the overall layout rejects any relationship with formal hierarchies, an "organic layout" is perhaps the best way to describe Ecolonia. There are no focal points. Streets change widths erratically throughout. As a result, this particular layout contributes to a number of diverse open spaces all over the community. There is little evidence of any design standards imposed upon the urban form. To Kroll, the design "is as a mosaic of equivalent but constantly changing elements... ...the pieces are just what we observed around Europe where people did something in an urban way" (Blundell-Jones 1992: 66).

Attached houses are the most common housing stock. This contributes to efficient use of land and affordability, and reduces energy needs. Roof lines, window heights, and entrances vary to create a diverse streetscape. In Ecolonia, small buildings lots are combined with large lots, and are often organized around a courtyard. The layout attempts to consume less land and energy. This layout is not uncommon and occurs in traditional European landscapes, but in the last fifty years has been substituted with designs utilizing land in an inefficient manner.

Environmentally Responsible Housing

In an attempt to emphasize diversity, nine different architectural groups were selected to design the buildings. Kroll opted not to be one of the nine, but his work is noticeable in the layout of the community. Each architect designed between eight to eighteen buildings. The choice of location for each architect was based on a random selection process.

Once the architects were selected, they were given certain design challenges and parameters outlined by the Dutch National Environmental Policy Plan. They were asked to choose and integrate a theme from the following three policies outlined in the Environmental Policy Plan.

- **Energy Conservation**: reducing the consumption of energy derived from finite energy sources by reducing demand, the use of sustainable energy and the optimization of energy saving devices.

- **Integral Life Cycle Management**: a closed circuit in materials use, in order to prevent the exhaustion of natural resources and reduce environmental impact.

- **Quality Improvement**: improving the quality, the surroundings, the construction materials and the indoor environment, and increasing the useful life of buildings.

In response to these criteria the architects produced some of the most progressive, environmentally sensitive and energy-conscious architecture in the Netherlands. Although each building design has its own unique design innovations, some design aspects were similar (Fig. 4.4). Every building is constructed on concrete "ecopiles", to compensate for any ground shrinkage, rather than placed on conventional piles containing a high amount of "embodied energy". The architects took extra measures regarding insulation to reduce primary energy consumption. Measures included mineral wool insulation on the underside of concrete floors and filled into the anchorless cavity walls. The architects avoid the use of endangered tropical hardwood, and they specify hardwoods from Europe, but still use wood from Canada. All taps are fitted with water-saving nozzles and flow imitators. The bathrooms include low-flush toilets and water-saving shower heads. The architects specify only water-soluble paints or linseed-oil-based paints. Basically, the intent was to use materials, technologies, and construction methods that contain low amounts of embodied energy, lessen the dependency on fossil-fuel-based energy sources, and were not detrimental to the health of the residents. The final cost of each house was estimated to be around $150,000 - $200,000 Canadian, matching the national average price for residential houses for people of similar income levels as in Ecolonia.

Figure 4.3: Two views across the site. View number one on the left looks east across the lake, while the second looking south across the lake.

Naturalized Landscapes

Around the community green space is rather sparse due to the fact that in this part of the Netherlands almost all development sites are cleared and covered with up to three metres of sand to compress the soil, at which time the site is stable enough to build upon. Without this process, development sites are susceptible to ground shrinkage, causing streets to fall below intended grades, leading to unforeseeable financial losses. Thus, as a result of the clearing, most of the trees are young and have a sparse appearance. Perhaps with age, the community will take on a more "green" and mature look.

Figure 4.4: Houses showing solar orientation and surrounding naturalized landscapes.

Final Remarks

Since the community is a demonstration project, it receives a large amount of attention and accommodates plenty of visitors. An information centre in the middle of the community showcases all the technologies discussed above. There is staff on hand to give group or individual tours of the community. They have a small library including names and addresses of the product manufactures and distributors throughout Europe. The information centre itself is a good example of ecologically conscious architecture. It includes water-saving toilets, energy-saving lighting, walls finished with water-soluble paints. Rainwater from the roofs collects in saving chambers via chains. The building has timber outer walls with clay internal walls.

4.2 Lebensgarten near Steyerberg, Germany

General Overview

In June 1994, I visited and worked for a week at Lebensgarten (Garden of Life), which is a spiritual and ecological community located 3 km outside of the village of Steyerberg between Bremen and Hannover. It was founded in 1984 and at present has a population of 120 people occupying 65 row houses on approximately 4 hectares of land.

Lebensgarten has an interesting history. It was originally built in 1939 to house the workers of a nearby Nazi ammunition camp. The English used the community as a barracks for a short period of time after the Second World War. It stood empty for almost eight years until two brothers from Berlin, both businessmen, purchased the land and houses. Their intention was to convert the community to a holiday resort, but ultimately they decided to create an experimental ecological and spiritual community. Today, the people of Lebensgarten come from diverse backgrounds, but with similar spiritual interests and the desire to live more harmoniously with the environment.

The two brothers own approximately two-thirds of the 65 row houses. The remaining dwellings belong to the members of the community. Two different opportunities exist for renting a dwelling in the row houses. Members either can rent a completely renovated dwelling for 500 DM per month, or an unrenovated one for 350 DM. In the latter case, the owners provide financial assistance for repairs to the exterior, but the renter has to acquire funds for renovations and repairs to the interior. Compared with rental prices, which range from 750-1000DM per month in this area, these prices are modest.

Layout and Design

The layout and design of the community have remained the same since its 1939 construction as an ammunition camp. It is a formal arrangement, with a town square in the middle that includes a fire pit and place of social gathering (Fig. 4.6). The square consists of four buildings including two row houses for residences, an old theatre building that houses an artist workshop and cafe and a recently renovated central hall containing a kindergarten, offices, kitchen, bakery, dining rooms, and food stores. The remaining row houses are all either arranged in U-shaped courtyards, or lined up facing one another (Fig. 4.5). The people use these inner spaces for growing food and for socializing. There is a common house approximately 300 metres to the northeast of the town square; a place for people to stay during seminars. Near the main road, another row house consisting of a residence and a school marks the entrance to the community.

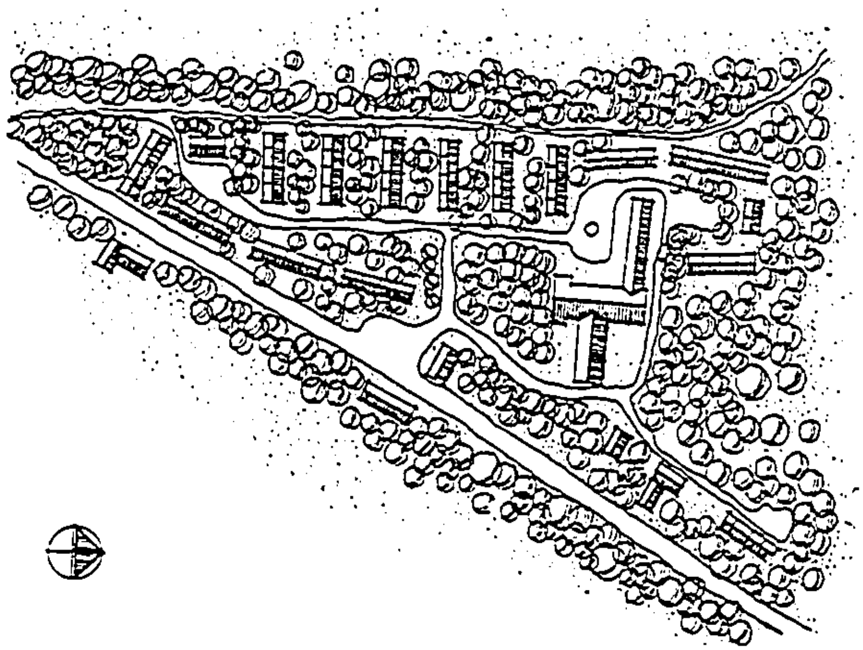


Figure 4.5: Site plan of Lebensgarten (Adapted from Kennedy and Kennedy, 1988)

Even though the physical design of the community is formal, the treatment of the landscape is informal. Paths run in many directions throughout, indicating a lack of formal design. As well, a variety of vegetation and gardening activities dominate the landscape. The gardens are privately owned, but there is a plan to create a common fruit and vegetable garden for the common kitchen. Each household practises organic gardening and the lawns are only mowed two times each year to cut down on energy emissions that would otherwise be expended through lawn maintenance. As a result of the large amounts of green space, the community has a comfortable appearance, creating an overall impression of a community of houses and gardens.

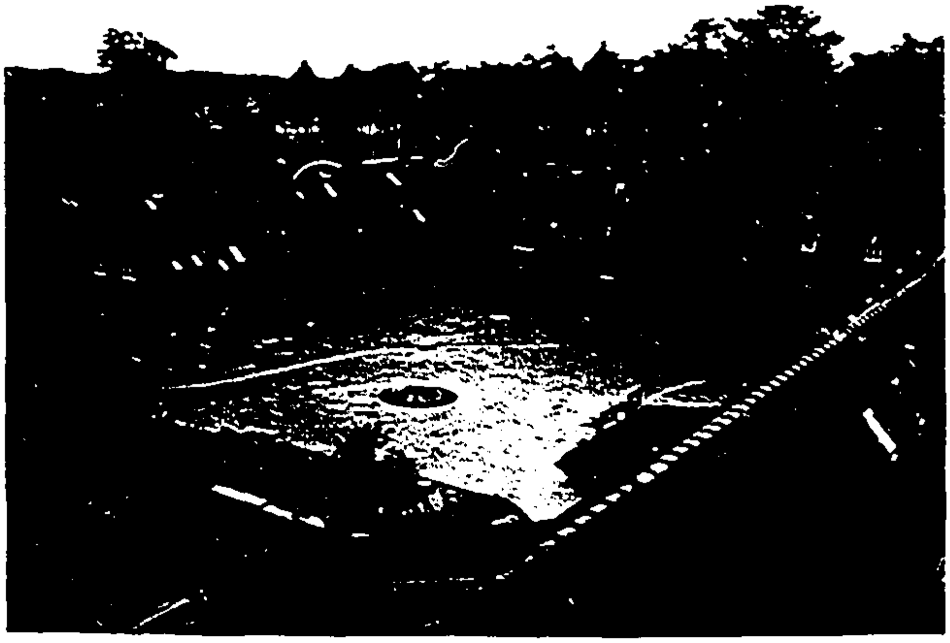


Figure 4.6: Town square around a fire pit.

Community Economics

There is a range and socio-economic diversity in the 120 people of the community. The overall economic structure is based upon individual earnings. For a short period of time the community tried to implement a new money system, based on an interest-free exchange of services, but abandoned it because members were reluctant to put a price tag on everything they did for others (Kennedy and Kennedy, 1988). Based on statistics in recent literature (Gilman and Gilman, 1991; and Kennedy and Kennedy, 1988) and from discussions with people in the community, I learned that incomes come from three equal sources. The first group acquires an income from outside of Lebensgarten. The second group is able to produce an income internally, while the remaining have their needs sustained in a number of ways. For example, some people produce arts and crafts products, two members bake for the common all-vegetarian kitchen, two women run a cooperative convenience store, and recently one man has started a bookstore that does mail orders to various destinations in Europe (Gilman and Gilman, 1991). One of the main sources of internal income is the number of seminar courses conducted throughout the year. These range from courses in horticulture and ecology, to courses in tai chi and vegetarian cooking. All of courses are listed in an brochure published annually by the people of

Lebensgarten. The third and final group are retired or on disability compensation, while others are simply unemployed. The unemployment situation is average in comparison with the rest of Germany, where in 1994 the unemployment rose to its highest level in 50 years. A small percentage of the residents are students who come to Lebensgarten to apprentice as architects, landscape architects, botanists, or other fields of study.

Environmentally Responsible Housing

All houses are original construction from 1939. Since 1984, architects Declan and Margrit have designed, built, and monitored a number of innovative ecological experiments in the community. From 1988 to 1989 the two architects began work on experimental projects for the Commission of the European Communities to demonstrate how design studies can help members of the building profession utilize passive solar technologies in an effective manner.

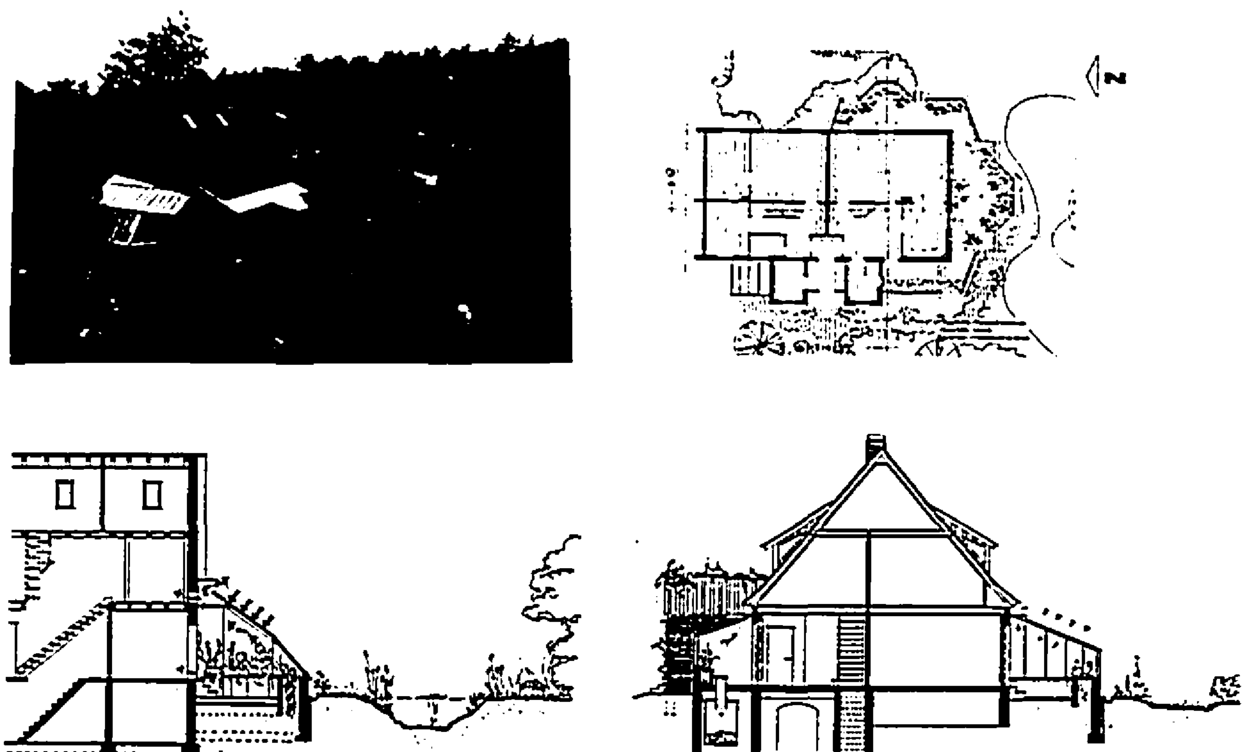


Figure 4.7: Experimental atrium with building section.(Section from architects Declan and Margrit Kennedy)

The first project was the construction of an atrium attached to the south-facing side of a cottage at the end of one of the typical row houses (Fig. 4.7). The cottage, a three-storey building part of the original 1939 construction, posed many challenges in integrating the old with the new. The atrium, constructed in 1989, involves many experimental features in this new exterior room. Solar collectors running on a 12-volt circuit provided the power for a ventilation system that automatically opened and closed top-hung windows and roof flaps. The system prevents overheating by opening windows at 35 degrees Celsius and then closing at 24 degrees Celsius. This particular device allows the owner to let the atrium take care of itself, avoiding any damage to plants through sudden changes in temperature, or closing when raining to protect from overwatering. Excess heat from the solar collectors is not wasted, but stored in underground magnesium tanks for long-term storage. Otherwise, heat from the atrium in the winter passes through the cottage ventilation system, bringing warm air throughout during cold winter months. Rainwater from the roof is used to water the interior plants, and is also connected to the humus toilets, thereby conserving energy during the treatment of "waste". The atrium provides a setting for plants to grow during all four seasons and produces ample fruits and vegetables for the residents of the cottage. The excess heat stored in the magnesium tanks provides a source of supplementary heating when the temperature falls below normal levels. On the exterior, gardens aid in the function and aesthetics of the atrium. Deciduous trees protect the atrium and allow the sun to heat the atrium during winter. In addition, a small pond outside serves as a reflecting pool, allowing the low winter sun to reflect its light against the atrium

Ecologically Sustainable Landscapes

A second and constantly evolving experiment is the 7.5-acre permaculture project instigated and supervised by Declan Kennedy (Fig. 4.8). In addition to being an architect, Kennedy is the current president of the Permaculture Institute of Europe. Although permaculture is now gaining wide acceptance throughout Europe and North America as an alternative to modern agricultural practices, it was originally practised in Australia by Bill Mollison. The concept reflects a permanent agriculture, one that strives for a self-reliant agricultural system and a holistic approach to food production. Webb (1993: 3) says, "it emphasizes the connections between systems and views the natural ecosystems as its basic design model."

The permaculture project in Lebensgarten began in the winter of 1987 with an extensive on-site design of the project, and continued later that year with the planting of approximately 2000 trees and shrubs. According to the two gardeners working in the permaculture field this summer, the layout of the plants serve a specific design function. Many of the larger trees were planted in U-shape formation facing south to capture and hold the sun's heat. In this particular situation micro-climates are created and utilize the full advantage from a natural resource. This formation serves a dual purpose in that it also acts as a wind break for the more vulnerable younger plants.

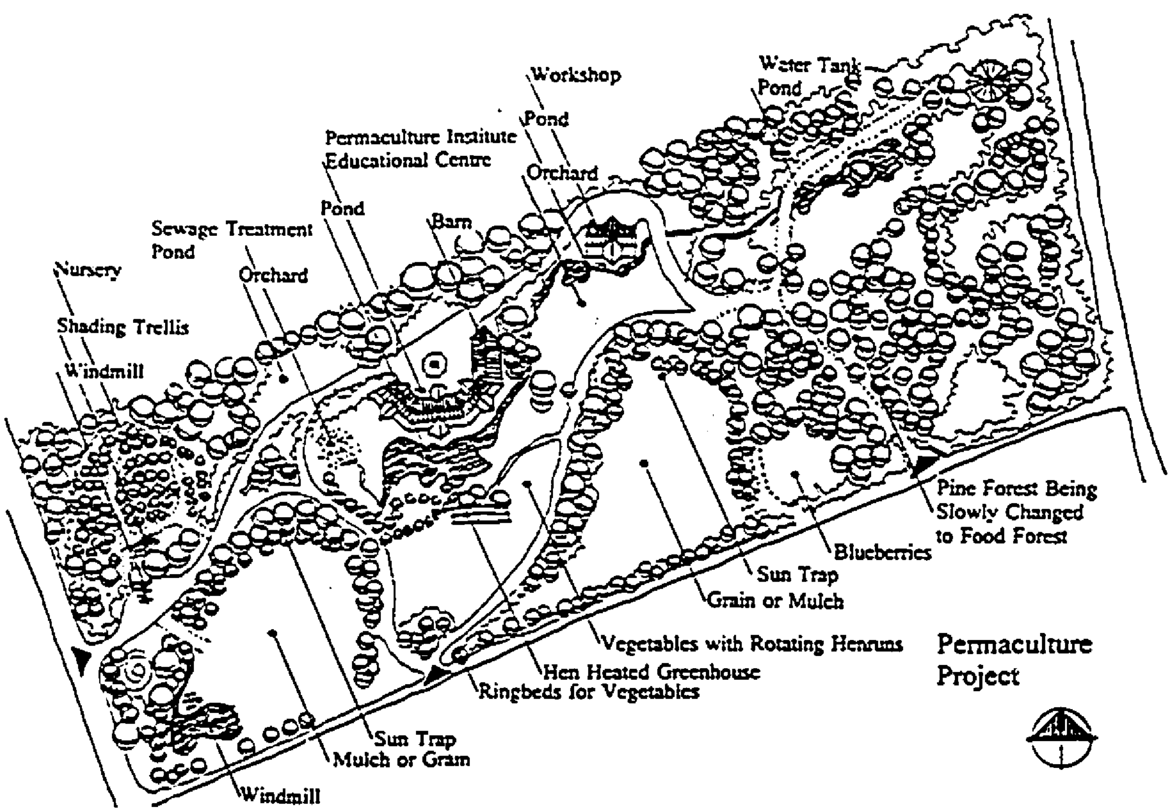


Figure 4.8: The permaculture project (Adapted from a sketch by Kennedy and Kennedy)

In light of the project being an experiment, there were some failures or "learning experiences". Because of the permaculture fields location in a forest, a fence had to be placed around the perimeter to protect the fruit trees from deer. The site is sandy, which is evident by the large surrounding stands of pines that typically grow in well-drained soils. Cardboard was used below the rootball of newly planted trees with plenty of compost placed to help retain any rainwater. Mulch was also placed around the surface of each tree for additional rainwater retention. The plants of choice are obviously native ones. As part of an evolving experiment, those involved with Lebensgarten offer courses on permaculture gardening and hold international conferences. People also constantly visit the project to build upon their own personal knowledge.

Alternative Energy Sources

The people of Lebensgarten have been involved in a number of projects with a strong focus on energy conservation. First, the community owns a solar-powered car available to members wishing to use it for short trips to the shops in Steyerberg. The car has a running time of 40 minutes, and can be recharged when hooked up to the power source. Second, the community centre has been renovated to include an atrium similar to the one described earlier. This building houses a kindergarten, community kitchen, seminar rooms, and the office of the European Eco-Villages Information Centre.

A cogeneration plant located in the basement of the community centre produces heat and power for the entire newly renovated building. The reasons for the cogeneration plant (a combined heat and power plant) is to use biomass resources such as straw, wood, manure, and other similar materials. Approximately 85-95% of the fuel energy content is utilized, compared with 55% efficiency rate of centralized thermal power plants (Vikkelsø, 1993). In addition, the cogeneration avoids energy loss due to the fact that power is closer to the source and has less distance to travel. The technology is simple so members can operate the plant themselves.

Final Remarks

In recent years the community received international attention for its contributions to ecological community planning. In the 1991 report *Eco-Villages and Sustainable Communities* prepared by the Context Institute, Lebensgarten was one of approximately 20 ecological communities surveyed around the world. That same year the Context Institute interviewed architect Declan Kennedy in an issue of their quarterly magazine *In Context*: "Living Together: Sustainable Community Development", in which they discussed the social aspects of living in Lebensgarten. In addition, Declan and Margrit Kennedy, both Professors of Architecture in Hannover, have compiled articles and research on the community that have been distributed worldwide. Another member, community planner Karl-Heinz Meyer, who manages the European Eco-Village Information Centre, has written the book *Zukunftwerkstatt Gemeinschaftsproject* (The Future of Working Community Projects). This book details the theory and practice of European alternative communities. Through the Eco-Village Institute of Germany, Meyer conducts courses in ecological landscaping and affordable construction. As well he has compiled a library focusing on the subject of ecological villages.

The ecologically oriented projects in the community continue. In the future, the community hopes to construct a Permaculture Institute Educational Centre in the permaculture project. This proposed building is a large house integrated with greenhouses. The new construction will be modelled after the lessons learned from the passive solar experiments completed previously in the community. The proposed design scheme contains living quarters for residents, visiting scholars, and apprentices, with a large portion of the building designed as a barn for a number of different animals. They expect to construct the projects within the next two to three years.

In summary, Lebensgarten is a community with a strong commitment to living in harmony with nature and developing social responsibility based on common spiritual beliefs. According to Declan and Margrit Kennedy (1988), a community must first have some spiritual aim, then an ecological one. Describing the spiritual component of the community the Kennedys write:

> ...the world is our mirror. The difficulties we have with other people (or other

physical, economic or social structures) always represent the difficulties we have to overcome *within ourselves*. We are not victims, but fellow creators of our own experience of our own lives (1988: 4).

With regards to this spiritual belief and ecological communities they claim:

> we had seen too many ecological projects that had drowned in the swamp of interpersonal problems, this is why we considered the spiritual aim (over an above the ecological objective) in Steyerberg as an important possibility. We felt it is necessary to create not only a different relationship between the people and nature, but also between the people themselves" (1988: 4).

Thus Lebensgarten strives to illustrate how the integration of spiritual and ecological ways of living provide an alternative to the norm.

Figure 4.9: Pedestrian friendly streets of Lebensgarten

4.3 Frasenweg in Kassel, Germany

General Overview

Kassel is a city of 215,000 in the west of Germany. Located at the edge of a nature reserve 3 km from the centre of the city, this 25-unit ecological housing project was designed in 1982 through an intensive collaborative process guided by architects Gernot Minke, Doris Hegger and Manfred Hegger. Nearly 10 years after construction, Frasenweg remains an early example of Germany's growing number of ecological communities, and a reflection of the architects' ideals and convictions.

The project originated when a small group of houseseekers became interested in trying something innovative in terms of how they wanted to live. Frasenweg was the architects' first construction project, where previously the group focused on research and development aspects of architecture and planning. According to Doris Hegger, there were two overriding reasons why people wanted to live in an ecological community. The first was to live in a community where houses would have less impact on the land, and second, a desire to live communally, where they could share friendships with people of similar interests.

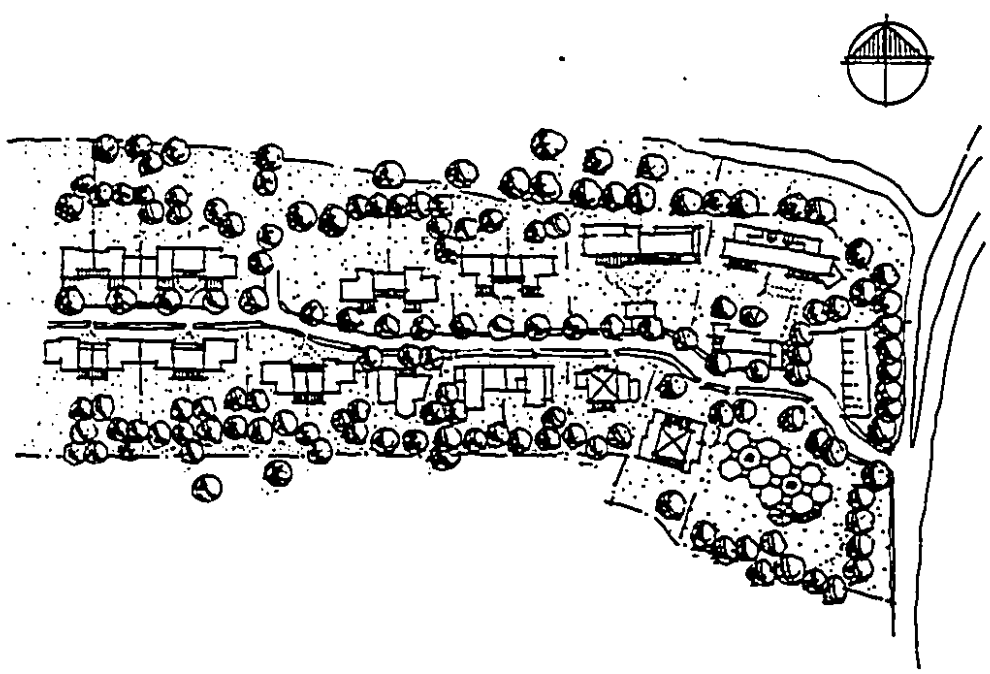


Figure 4.10: Site Plan of Frasenweg (adapted from Molinari, 1991)

Layout and Design

Frasenweg is a low-density housing project averaging about 3.6 units per acre. The houses are placed on both sides of a large pedestrian path running east-west through the community (Fig. 4.10). The path is lined with private vegetable gardens and outdoor spaces extending from the front of the homes. The houses to the north of the path are duplexes, while those to the south are duplexes and single detached houses. There are two offices adjacent to the path at the east end. The style of these buildings is based on geomantic design, a historic form of Chinese site planning known as Feng Shui.

A community carport is located at the entrance (Fig. 4.11). Residents park there instead of bringing their cars inside the community. The carport has a grass roof and is built into the earth to protect the community from surrounding automobile sounds. Although the people have a short walk, Doris Hegger commented that residents are not really bothered, as they understand the benefits are much greater than the losses (eg. traffic-free zones, and safer, cleaner, environments). A design of this character was possible because the group was able to acquire a site with private roads, allowing them to make alternative design solutions for traffic circulation.

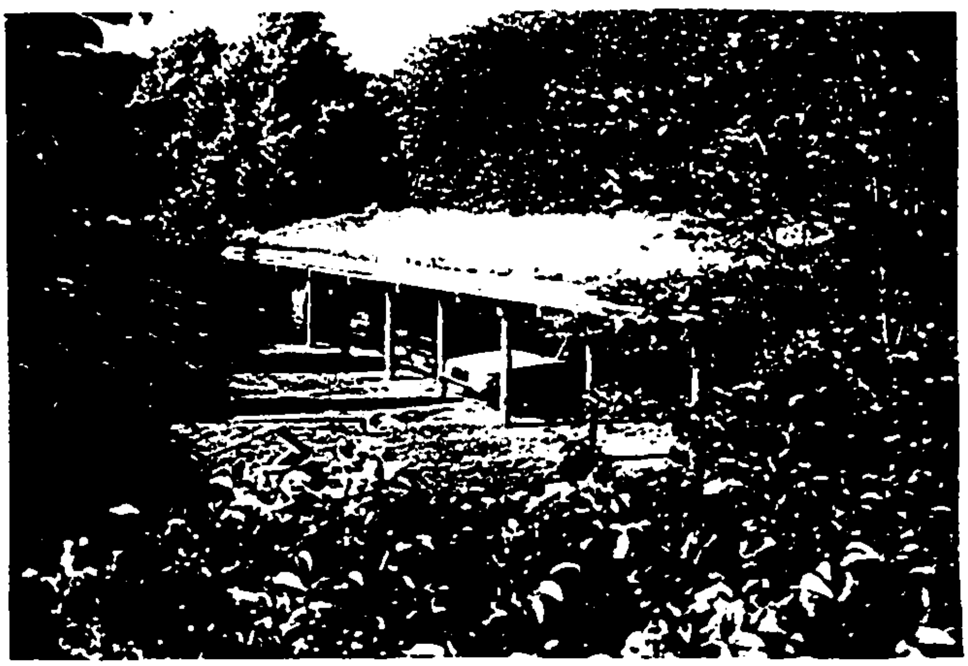


Figure 4.11: Carport at the entrance of the community.

The majority of the buildings are double single-family dwellings, or what we in North America refer to as duplexes (Fig. 4.12). The exterior of the houses are a made from wood from the Larch tree, native to this part of Germany. The architects decided that the load-bearing structures would also be made of wood because this type of structure makes house construction less complicated. Aluminum is found in some prefabricated glazed walls, but otherwise avoided because in energy terms it costs 10 times as much to produce as steel (Molinari, June 1991). Overall, wood is the main construction material.

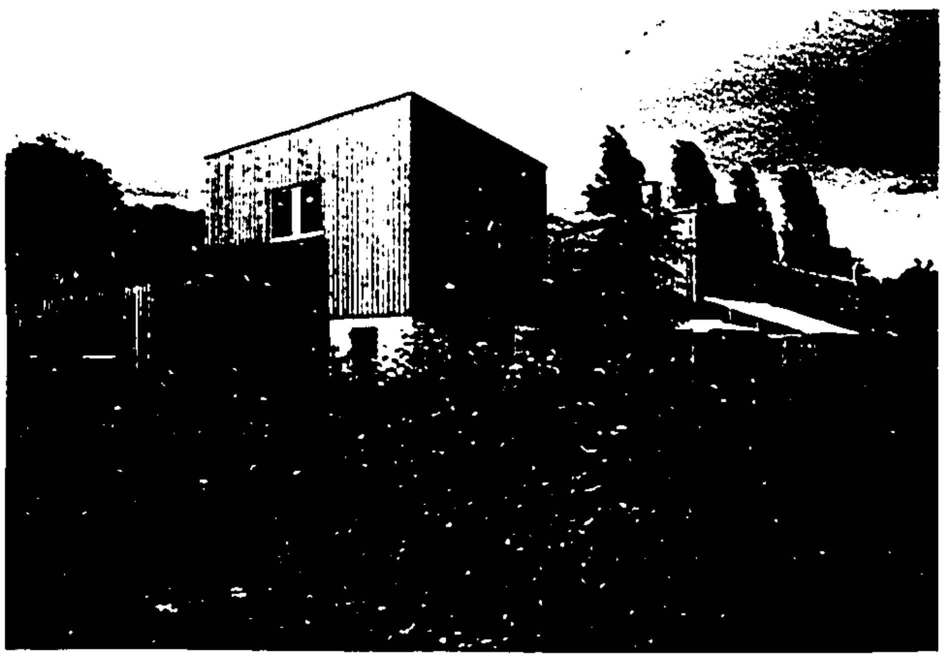


Figure 4.12: A typical duplex showing the outer walls constructed of larch and the surrounding ecologically sustainable landscapes.

Various design solutions reduce energy consumption. However, not all the optimum solutions were applied. Ten years ago many of the energy-saving devices available today were not affordable in the housing industry. These high costs prevented the designers from incorporating central heating. However, houses are constructed with a high standard of insulation, use of efficient heating systems, recovery of heat by condensing used gas, and supplementary heating systems such as wood stoves. Verandas and atriums are attached to the south-facing sides of the housing. The intent is to circulate heated air from the atriums through the house in the winter. In the summer, though, Doris Hegger mentioned that at times the atriums got too hot. In retrospect, she suggested that the low-tech atriums perhaps would function better not facing directly south, but oriented more to the east or west. In addition to the energy-efficient factors listed, windows on the north side are small, minimizing loss of heat during the winter months. Essentially the house designs avoid high-tech systems, but instead employ passive ecological system that require minimal maintenance or construction knowledge to repair.

Wastewater Treatment

The architects prepared many design solutions to conserve water. Every surface in the community is permeable. Any rainwater entering the community eventually makes it back to the ground water supply. For instance, the road entering the community is covered in gravel, which eliminates problems related to urban runoff. Grass roofs, the *sine qua non* of most Northern European ecological design projects, collect 70% - 80% percent of all rainwater. Some of the houses capture rainwater and use it for toilet water. The excess rainwater gets transported by downspouts to the gutters, where it is retained in barrels (Fig. 4.14). Residents use the collected rainwater to water their gardens. The remaining surfaces in the community consist of private vegetable gardens and open space. This water conservation concept considers the rainwater not as waste to be discarded immediately, but as a resource. Sewage from the houses, however, is sent to the city treatment plant because bylaws declare on-site treatment illegal.

Ecologically Sustainable Landscapes

On the exterior, elaborate gardens surround every house. The abundance of planting is in part a result of the action of the city council, which donated plants under the "Action of 7000 Trees", a foundation created by the famous modern artist Joseph Beuys. Some houses, such as architect Gernot Minke's former residency, are completely submerged in plant growth (Fig. 4.13). Basically, the planting designs mimic nature, giving a free and natural effect. This approach to gardening is unusual in Germany, where landscape architects usually practise a formalist, or at least organized approach to garden design. These gardens are not just for ornament, most residents harvest an ample supply of fruits and vegetables. They even harvest onion stalks from the roofs and use them for salads.

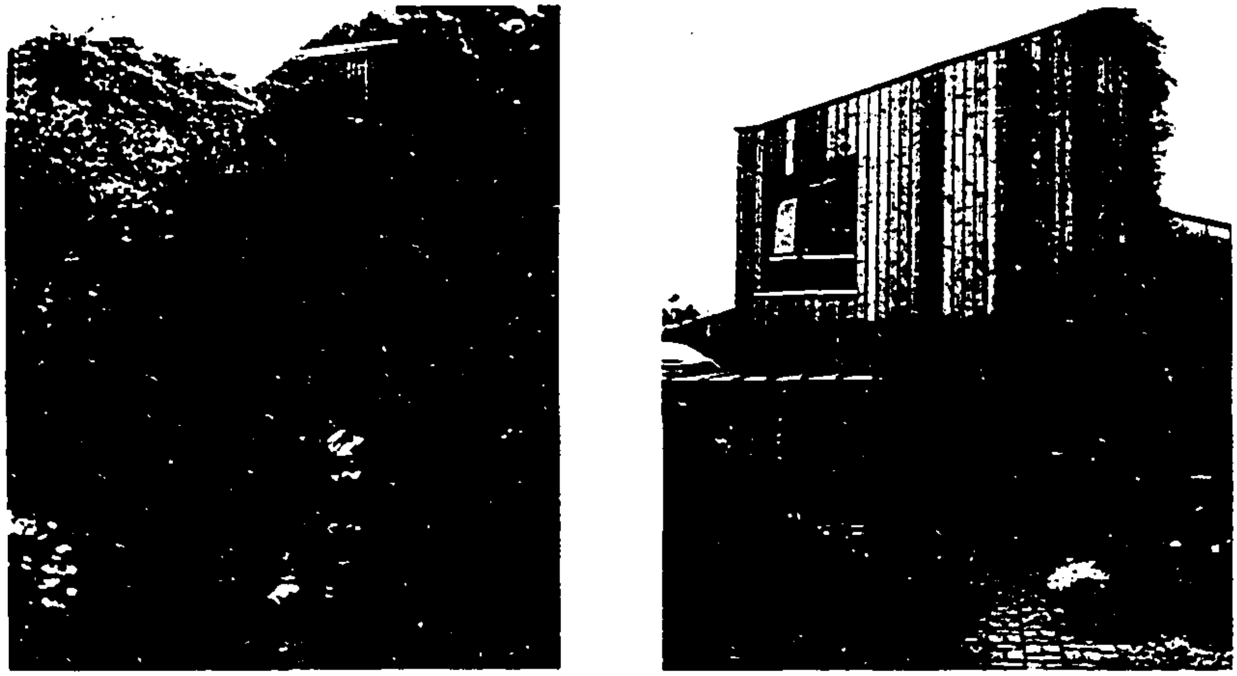


Figure 4.13: Two front facades. Left: The octagonal-shaped house designed by Gernot Minke. Right: A duplex with climbing plants, south-facing atrium, and an organic front garden.

Waste Recovery in the Community

Waste in the community is kept to a minimum. Every resident practises recycling as a way of life, so much so that the residents reduced waste by 50%. In light of this fact, residents have convinced City Council to reduce their garbage collection tax also by 50%. Recycling is more convenient in Frasenweg because there is provision for recycling stations included in the design of the houses. Residents keep paper for reuse or separation, compost organic waste for use in the garden, and transport glass and toxic waste monthly to city council collection points.

Most ecological communities identify waste, separate the compost, classifying hazardous materials and thus reducing the volume of unusable materials. This approach leaves little material that can cause environmental damage.

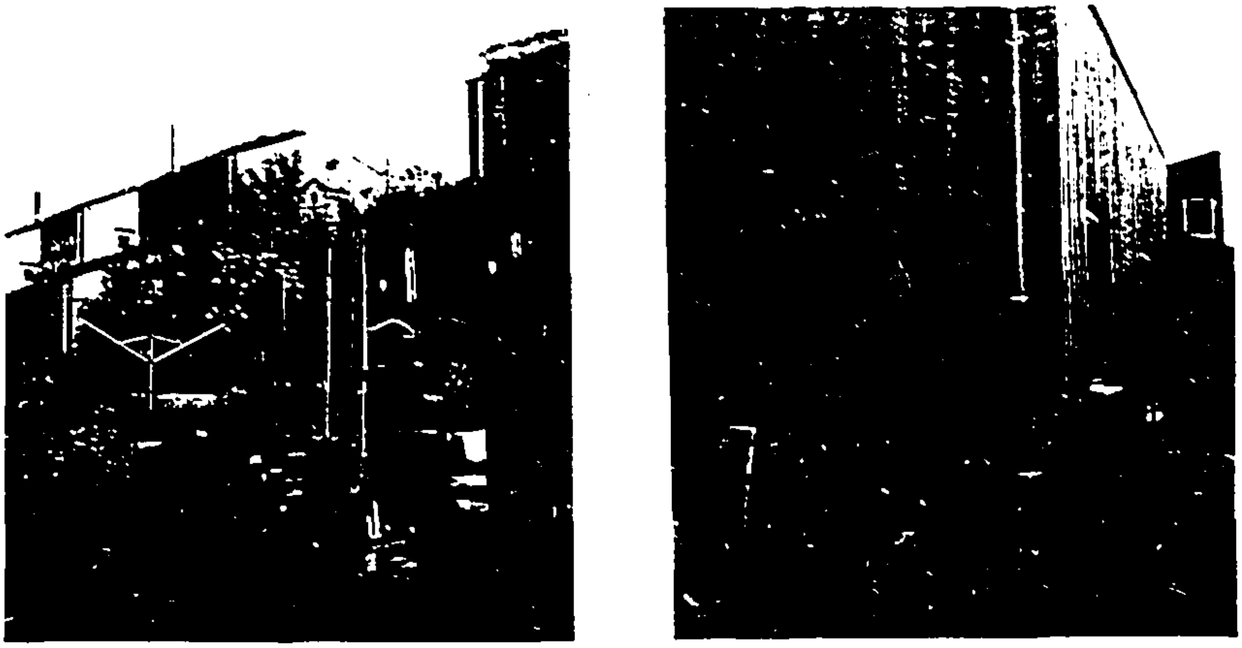


Figure 4.14: Left: Backyard gardening activities, including bee-keeping for honey. Right: A typical downspout that recovers rainwater for gardening.

Final Remarks

The project experienced few problems because the architects and the residents devised a thorough project schedule. They formed an association called "Taskforce: Ecological Housing Kassel". Members of the group donated 200 hours on common projects and invested 3000 DM for common purchases and miscellaneous expenses. Once these parameters were set, the task force approached the city in search of a piece of property that would fill their needs.

They experienced some difficulties when negotiations began with the City of Kassel for it was difficult for the city and the task force to agree on the location. The city was apprehensive about certain sites because of their proximity to the more established parts of Kassel. Nevertheless, the architects were sympathetic and understood the city's position. It was an experiment and there is regularly chance for error.

Since the development of the project, architects and town planners from around the world have visited the community. Manfred Hegger noted they had few visitors from North America, but over the years there has been a tremendous amount of interest from Japanese architects and developers. The interest in Japan lies in building large-scale projects consisting of 200-400 dwellings. These projects are developed by the government and then sold to the people. He said this is exactly the opposite route the people of Frasenweg have taken. From his experience, Hegger says the chances of success are much higher in an ecological design project when the residents have a closer attachment to the design earlier in the development stages. In conclusion, he pointed to the fact that Frasenweg is now 10 years old, and almost all the original owners still live in the community.

4.4 Vallersund Gård, Norway

General Overview

Vallersund Gård is located on a wind-swept peninsula in the North Atlantic approximately two hours from Trondheim, Norway's third largest city. Vallersund Gård is more of a farm, since the word Gård in Norwegian can be directly translated to farm. There is a long tradition of farm living, and today the government provides assistance to rural areas. I have decided to include Vallersund Gård in this study because it represents a Norwegian way of community life and farming that is ecological in the way the community functions.

The existing village today is about 12 years old, although Vallersund Gård's history is much longer. In the 1700s, Vallersund Gård served as a trading post for the Norwegian and Russian fleets fishing in the North Atlantic (Fig. 4.15). Over the last 250 years it remained a fishing community, until recent economic circumstances forced the fishing industry to become much smaller. At one time, the community served as a quarantined area for Norwegians with leprosy. Only since the last eight years has Vallersund Gård become an ecological community. Today Vallersund Gård consists of approximately 40 people, 14 cows, 3 horses, 8 pigs, and lots of chickens.

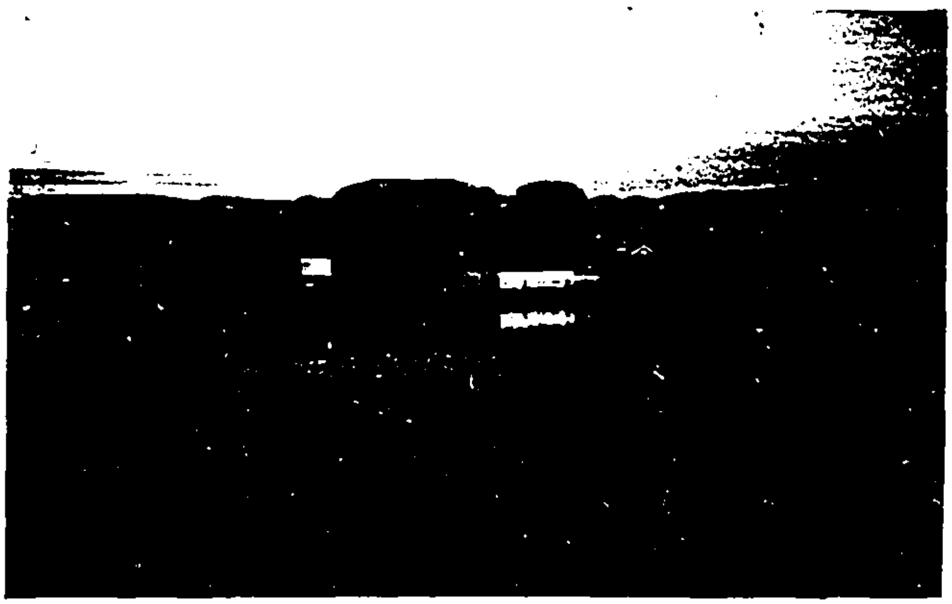


Figure 4.15: View of the edge of the community from and adjucent island.

Vallersund Gärd is one of six Camphill Communities in Norway. The Camphill movement runs communities throughout the world for children and adults in need of special care. There are approximately 80 Camphill communities around the world in over 18 countries. The Camphill communities are the result of the efforts of Karl König, an Austrian medical doctor, who, after fleeing Nazi-occupied Germany, moved to Aberdeen, Scotland, to establish an experimental community. Vallersund Gård, like other Camphill Communities, is a place where people with mental illness can come to be a part of society. Instead of the typical patient-client relationship common in conventional institutions, or an "us-them" scenario, all people living in the community are treated as equals. Where in North America, the medical profession debates the difference between "mentally retarded" and "mentally challenged", the people of Camphill have abandoned any classification system. For example, those trained as doctors, nurses, social workers, architects, and farmers are not referred to by their titles. People are all considered as equals.

Community Economics

The topic of incomes is constantly a source of curiosity for those interested in the functioning of Camphill villages. The income system in the Norwegian Camphill communities provides a common income for all, or what the workers in the community call the "hat". The Norwegian government pays the workers a salary depending on their education, and patients have a subsidized living. All workers receive 2000 Norwegian Crowns a month. Food, clothing, medical services, and vacations are in addition to the monthly salary, so all basic needs are met. The workers agree with the compensation and were more than satisfied with the income system. No persons abuse the system. In fact, the opposite is true. People were very conservative because any surplus money in the "hat" could be utilized for charitable purposes. In the last few years, the people of Vallersund Gård sent excess money to a new Camphill community being constructed outside St.Petersburg in Russia. In addition, Vallersund Gård constantly donates to local charities.

In 1989 Nils Christie wrote a book on Vidaråsen, a Camphill community in the south of

Norway, called *Beyond Loneliness and Institutions: Communes for Extraordinary People*. In his book, Christie writes briefly on this self-supporting income system. To build an argument for this income system, he compares the daily cost of running a Camphill community with that of somatic hospitals, psychiatric hospitals, prisons, and crisis centres. In every case the cost of running a Camphill is significantly more effective, sometimes by as much as 400%. Christie notes that the prices listed by the Camphill neglect to mention the extras, including housing, theatres, barns, and cafeterias. Also, the pooled income provided by the Norwegian government for a certain number of employees is stretched to include additional employees. For instance, Christie notes that Vidaråsen receives salaries for 30 people, while it employs 45 people, thus employing 15 people who may have otherwise been unemployed. Basically, the Camphill communities use their money in both an efficient and constructive manner which improves the community while community members maintain a modest lifestyle.

Layout and Design

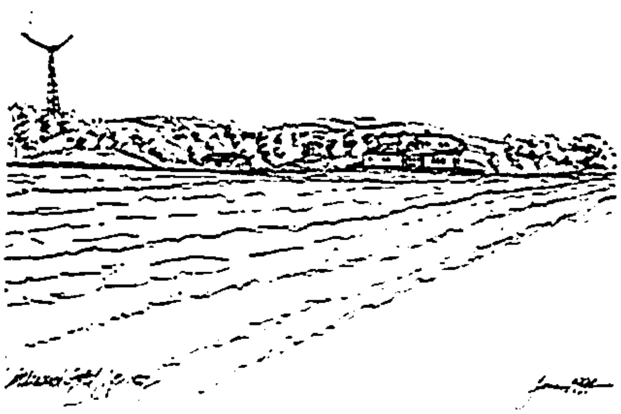
Vallersund Gård has a traditional fishing community arrangement in that the majority of the buildings are located close to the coastline (Fig. 4.16). Along the edge of the ocean, there are three buildings that include a long community living house, a boutique with an apartment in the attic, and a boat house on the wharf. The boat house is undergoing extensive restoration because the Norwegian government has designated it as a historic building. A large barn and workshop are in the centre of the community and house daily activities. These two buildings are surrounded by an orchard and vegetable gardens in a place where farm fields occupy a large proportion of the land. The remainder of the buildings are scattered throughout in small groves of trees and along the edge of fields. This formation is quite common in Norway, where they have an old saying that, "if you can see your neighbour, then you are too close". One building is a private retreat back in the hills containing a writer's studio and a traditional Finnish sauna. As well, Vallersund Gård owns a couple of houses in the adjacent fishing community, and also operates a kindergarten there. The kindergarten is constructed in a traditional Nordic style with a grass roof and painted in the rural red so common throughout the countryside.

Figure 4.16: Site Plan

Environmentally Responsible Housing

The architecture of Vallersund Gård consists of a blend of many restored historical buildings typical of Norwegian fishing communities of the past, and new buildings designed by the Camphill Architects located in Aberdeen, Scotland. Due to the fact that the community is growing, many of the immediate and future projects focus on building construction. In the past five years, the community has constructed two houses for families, a community centre, a kindergarten, and a large barn. In the coming years they hope to build a few more family houses and continue restoring a number of historically significant buildings. The community reduces the construction cost by doing most of the work themselves.

Joan de Deris Allen of the Camphill Architects is responsible for the design of new buildings, and for the restoration of the old (Fig. 4.17). Allen published *Living Buildings: Expressing Fifty Years of Camphill* in 1989, giving a history of her building theories and those attached to the development of the Camphill movement. Allen practises anthroposophical architecture, which guides the design of each building and serves to reflect the building's function while creating interesting and inspiring spaces.



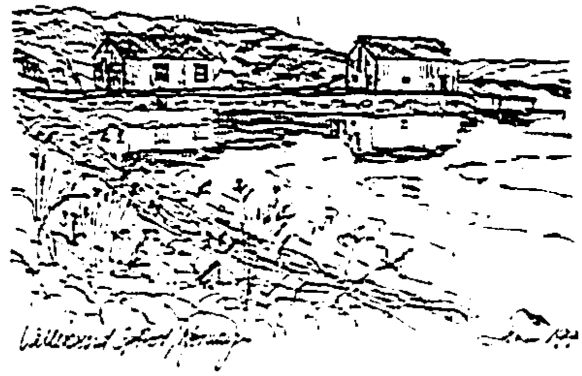


Figure 4.17: Sketches of community architecture. Left: A residence house designed by Joan de Deris Allen. Right: A boutique with guest rooms in the attic, and a boat house in the background.

Alternative Energy Sources

The first thing one notices when arriving at the community is the large Danish-built windmill high on a hill in the centre of the community (Fig. 4.18). It is the largest standing windmill in Norway. The windmill, now five years old, has produced almost 85% of the community's power over that time. Gerrit Overweg, the person responsible for the establishment of the windmill, says for 10 months of the year the windmill produces an excess of energy that is sold to the Norwegian power corporation at cost; in the remaining two months, Vallersund

Gård buys needed electricity for a much higher price than they sell to the power corporations. In the opinions of many windmill owners, this cost difference is as an institutional barrier for the construction of windmills in the future. However, the windmill at Vallersund Gård is optimally located high on a hill next to the North Atlantic, where windspeeds are high. In addition, the windmill, says one the residents, has a movable propeller that adjusts immediately to any changes in wind direction. This movable propeller allows for an increase of 8-10% efficiency, compared with conventional windmills (Vikkelsø, 1993).

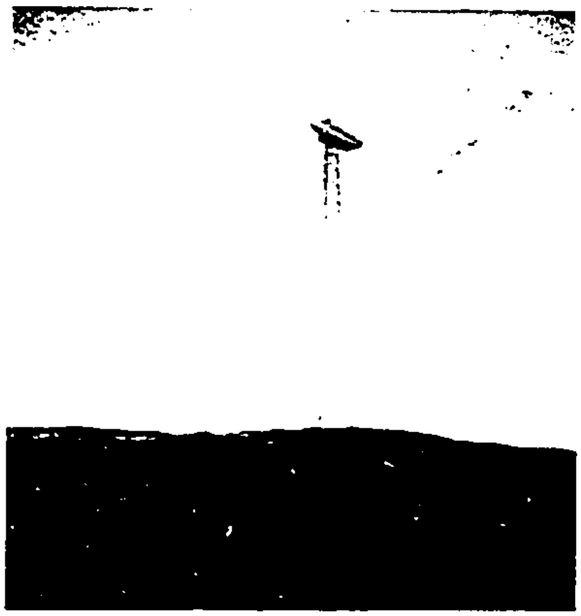


Figure 4.18: The community's windmill perched high upon a hill in the centre of the community.

Another significant ecologically benign technology is the heat pumps that extract heat from sea water to heat the hot water for the community. It is an experiment conducted by the Department of Engineering at the University of Trondheim exploring the application of this technology to communities similar in size to Vallersund Gård. The system takes water from the Atlantic Ocean from a depth of 35 metres, where temperatures are at a constant 10-12 degrees Celsius even in January. Heat energy is extracted from the water, which raises the temperature of the fresh water stored for the houses The pumps provide adequate hot water year round, but an electric system serves as a backup.

The control of the energy for communities in Scandinavia is more flexible than in most countries. In Norway the government has recognised that municipalities and communities are significant consumers of energy. Therefore communities have more control of the marketing and type of energy. Approximately 90% of the 200 retail utilities are owned by communities or by municipalities (In Practice, 1991). When communities have control over their energy supply, residents are more energy-conscious. As a result, interest in energy conservation increases, as well as the amount community specific information available and the amount advice from local governments concerning energy conservation initiatives.

Community Farming

Figure 4.19: One of the many multi-crop farming fields scattered throughout the community.

Farming is one of the main purposes in the village's existence. Instead of practising modern farming techniques that are heavily dependent on artificial pesticides, the farmers at Vallersund Gård practice biodynamic and biological farming, a type of agriculture that works in concert with natural processes instead of against them. They view nature as a resource to be cultivated, nurtured, and respected. The farmers have trained at biological agricultural institutes around Europe, and hold a number of convictions developed through their education and practice.

First, they make extensive use of compost to help restore the nutrients to the soil that are otherwise depleted when farmed. Second, they use only natural fertilizers such as fish and organic waste. Third, the farmers pay close attention to the traditional farmer's almanac. To the observer, this form of farming would appear to be archaic; the work is highly labour intensive, and the use of machinery is kept to a minimum. But the farmers of Camphill are disenchanted with the social consequences of modern farming techniques, and say even though their work is hard, the final product and process are much more fulfilling. In a country where farmers hold a high social status, the public and the government encourage biological and biodynamic farming, realizing that the land is the cornerstone to the county's economy and culture and must be conserved.

Figure 4.20: The community centre. A transformed cellar once used for preserving vegetables, a traditional building style still found throughout the Norwegian rural landscape.

Final Remarks

Since Vallersund Gård is in its youthful stages of development, there are a number of ecologically oriented projects planned for the coming years, such as a combined house and greenhouse building for about five more people. The house will serve a dual purpose of providing living quarters and allowing the residents to get a head start on planting fruits and vegetables that would otherwise be difficult to grow in such harsh climates. Another project, slated for the summer of 1995, is the creation of three wetlands to restore agricultural waste and household wastewater to a condition that will be less harmful when they are returned to the natural environment. The hope is to involve Norwegian universities and students interested in environmental design to assist in the design and construction of this biological wastewater treatment system. As a result the students and the universities can learn thorough the process, both in the design and construction stages and in the evolution of the project over the years, thus creating an outdoor classroom.

In summary, if one were to visit Vallersund Gård, one would notice that the most ecologically responsible aspect of the community would be the lifestyle the people maintain. The members all incorporate ecological practices into their way of life, from the way they take care of their animals to the way they prepare their food. For example, residents brush the cows down prior to milking. The cows are never forced to produce milk in excess of their capabilities, since many researchers argue that high-production farming places excess stress on animals. Recycling, composting, and water conservation are highly practised. Members voted against purchasing unnecessary appliances such as dishwashers because they argue that these appliances are wasteful in their functioning, adding that washing dishes is often a social opportunity where many people collaborate to finish a job quickly. In their opinion, the car is a tool. Most people ride a bicycle for transportation; three automobiles are reserved for long distance trips. Essentially, residents at Vallersund Gård all live within their means; a point any environmentalist would argue as the main contribution to conserving the natural environment.

4.5 Järna, Sweden

General Overview

Nearly 35 years ago, a small group consisting of an architect, gardeners, painters, sculptors, and teachers—all from the anthroposophical movement—came to Järna, a town of 7000 people 50 kilometres South of Stockholm, to establish a Rudolph Steiner Seminariet. Their main intention was to create a self-supporting community for the education of teachers for the some 500 Waldorf schools around the world. They wanted a place where all disciplines from the arts and sciences could come together to learn from one another, and consequently build a humane environment. Today, the Rudolph Steiner Seminariet has a population of approximately 1,500 people.

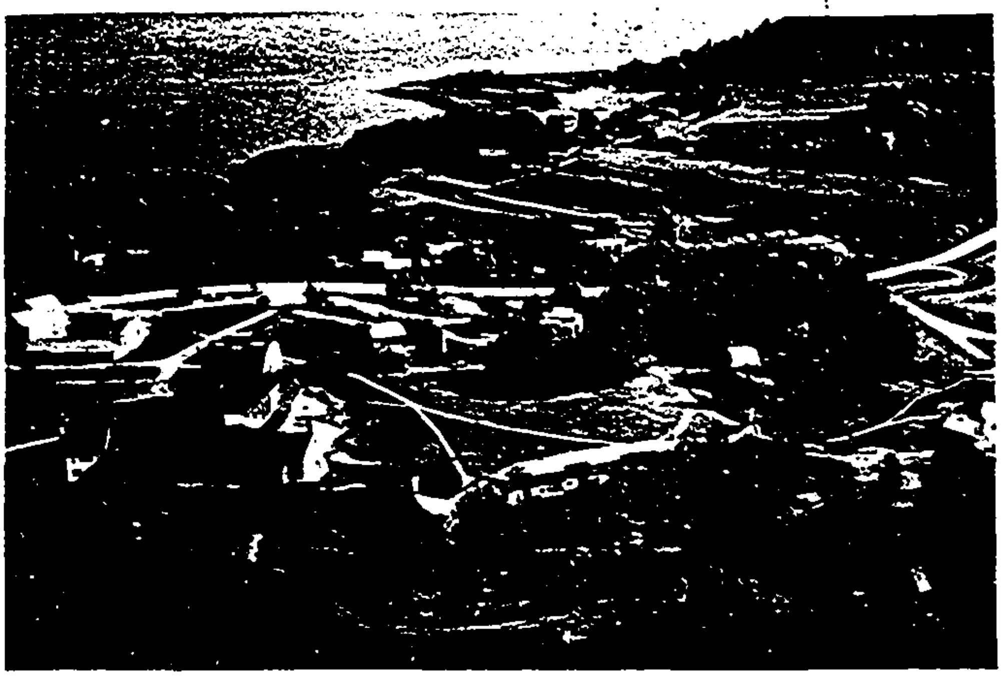


Figure 4.21: Aerial View of Järna (Photo by Max Planger, 1994)

Almost all of the aspects of the community incorporate the ideas and teaching of Rudolph Steiner (1861-1925), an Austrian-born philosopher, scientist, artist, and founder of the anthroposophical movement. As its name implies, anthroposophy pertains to "the wisdom of man". The underlying principle of the anthroposophical movement is that "man's interior world is an autonomous reality and does not, as in materialistic views, depend on its physical shell for existence" (Lachman 1994: 23). Unlike others developing highly theoretical countersocietal ideas, Steiner played close attention to the transfer of his ideas from theory to practice. He lectured and wrote constantly on the application of his new philosophy. Due to his scientific background, Steiner was interested in testing the realities of his theories, and transferring his theories into practice. When he wrote about education, he developed the Waldorf Schools for creative education. His concerns about agriculture established bio-dynamic farming. His lectures on curative healing instigated the founding of a number of anthroposophical hospitals. His views and practice of architecture have been responsible for the anthroposophical movement being widely practised throughout Northern Europe. And his hope for materialising humane environments can be witnessed in the community of Järna.

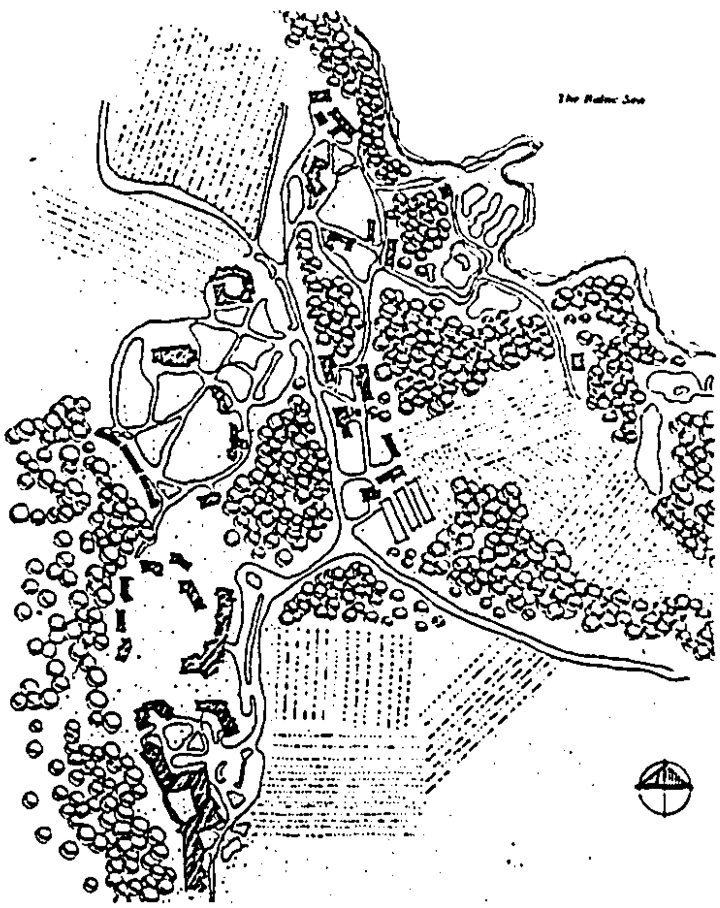


Figure 4.22: Site Plan (Adapted from Hahn, 1988)

Layout and Design

Järna is set on a solitary rural site about 20,000 sq.m. in size (Fig. 4.22). The buildings are placed harmoniously on the landscape, similar to the landscapes of the midwest and prairies. It appears as if the buildings are randomly placed, but, after spending time walking through the community, one begins to understand that there is an organic formal quality to the layout. The community is organized around a series of large courtyards or open spaces. Almost every building shares a public space, while still maintaining private outdoor spaces.

Since its conception, the community has grown in a series of successive stages. Most of the buildings are for housing the residents of the community, many of whom are students living in dormitories (Fig. 4.23). There is a combined restaurant and shop, a library, dance hall, music conservatories (Fig. 4.26), and a number of artists' studios scattered throughout. Just outside the immediate community, a large grain factory (Saltå Kvarn) and bakery sells its products all over Sweden. In 1985, the community established the first anthroposophical hospital in Scandinavia (Fig. 4.24) (Coates, 1989). Recently, construction of a large auditorium (Kulturhus) was completed, providing a concert hall for the musicians of Järna. In the coming years, the community hopes to become the home of an anthroposophical university, for the specialization of Steiner education, bio-dynamic farming, eurhythmic dance (a form of rhythmic dance and ballet), and for the renewal of the arts and of architecture.

Figure 4.23: Orman Länge (long snake), the student dormitory and seminariet, with common kitchens at each end of the building.

Environmentally Responsible Housing

Arriving at Järna, what immediately strikes one's attention are the buildings whose shapes, colours, and mere presence are, to say the least, original and eccentric. Almost all of these buildings were designed by Erik Asmussen, a Danish-born architect who moved with his family to Järna in 1977. Asmussen talks of metamorphosis and organic form along the same lines as Steiner did, but his work is by no means an emulation of the Steiner's architectural convictions. Asmussen's work is completely individualistic, yet heavily grounded in Nordic building traditions. The first impression could leave you to believe otherwise, but closer observation reveals the use of pure Scandinavian building materials and techniques. Asmussen's medium is wood, as opposed to Steiner's use of concrete as his material of choice in his Goetherium in Dornach, Switzerland. Roofs are made of traditional tin, which, says Asmussen, adapts easily to the organic shapes in his expressionistic designs. Essentially, Asmussen has created buildings with life that frequently change in shape from concave to convex, from vertical to horizontal, and in colour, thus creating building environments that are stimulating to the user. This approach to design is what Steiner intended when advocating a new direction in architecture.

Figure 4.24: Vidarklinken is a 74-bed medical clinic and healing centre, including dwellings for medical staff and medical students. (left photo by Per Ola Norman) Right: Rear view of the hospital.

In defining his own version of anthroposophical architecture and elaborating on Steiner's definition, Asmussen writes:

> As I understand it, the goal for anthroposophic architecture is, through design and using whole form language (the shape and function of the building), to strive to create a stimulating environment which through its special atmosphere can act as an inspiration to just the activity the building is interded for. In a deeper sense it has naturally always been like this, when one took functionalism seriously and stopped just playing with abstract beauty of form, or one-sidedly allowed rational methods of production to dominate" (Asmussen, 1984: 44).

In conversation Asmussen described the special use of courtyards and how this space plays a major role in the design of his buildings. Courtyards, however, have long been a traditional aspect in Scandinavian architecture. In Järna, the courtyard in the cafeteria is for social eating and creates a microclimate by trapping sun and blocking the strong winds from the Baltic Sea. In the hospital, the courtyards are rest areas for the patients. The courtyards are often full of life. In either case, they allow a person to benefit from being outside without experiencing the uncomfortable climates at various times of the year (Fig. 2.25).

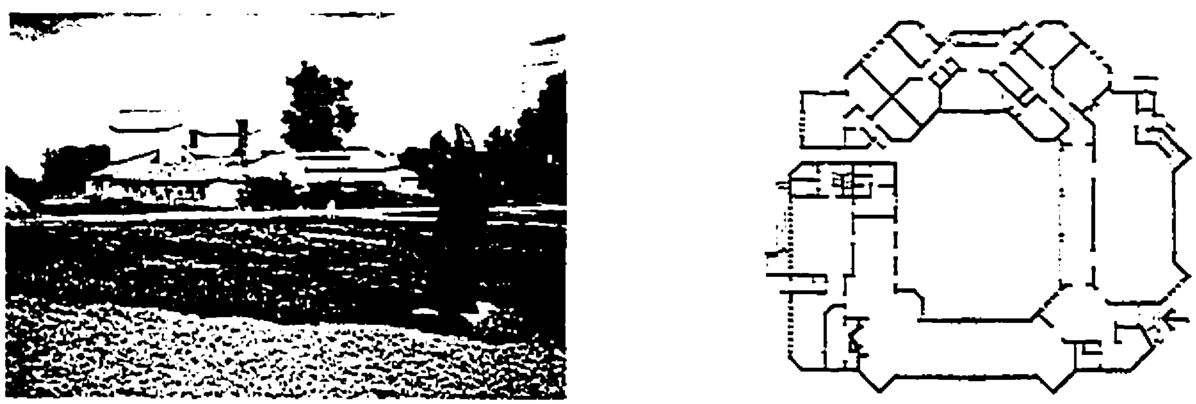


Figure 4.25: Robygge contains a cafeteria, dining room, two eurythmic rooms, gift and book shop, offices, and one dwelling.

Many of Asmussen's buildings are painted in strong blue untraditional colours, while others have a warm translucent, pastel appearance. The colours have been developed in collaboration with the German artist Fritz Fuchs, who creates the colours from a mixture of vegetables and mineral dyes mixed with another extract from bee wax. The colours are translucent because they are applied in a number of thin layers. Asmussen says this allows one to see what the building is made from. The transparent colours let one see the grain and type of wood which otherwise would be concealed. The choice of colour spectrum is blue, a strong contrast to the traditional Swedish building colours of red and yellow. According to Asmussen, he and Fritz Fuchs wanted to set themselves apart from this tradition, and they believe that in an abstract way the blue colours of Järna represents heaven, while the traditional Swedish colour on the red spectrum represent the earth. Thus the opposite colours on the spectrum create a dialogue between the two extremes.

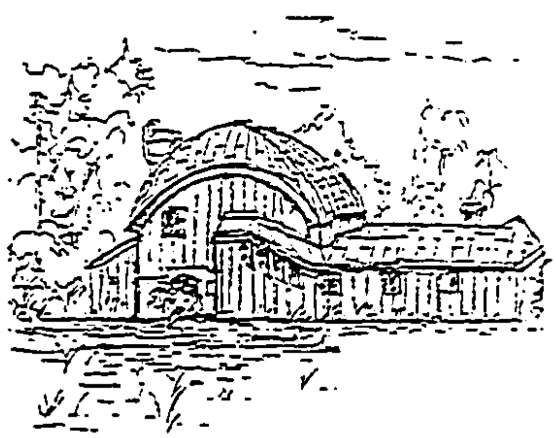


Figure 4.26: Almandinen contains a music hall and a residence for the music instructor. The large vaulted roof provides optimal acoustic, and the buildings form responds to abruptness of the surrounding escarpment.

Ecologically Sustainable Landscapes

Around the entire community there are a number of elaborate ornamental, vegetable, and medicinal gardens. These gardens are the product and guidance of Arne Klingborg, one of the founding members of the Rudolph Steiner Seminariet, who is an artist, gardener, and prolific writer on garden architecture. His topic of interest is the evolving garden; he wrote a book titled, *The Ever Changing Garden*, pointing to the garden's ability to adapt and blend to its surrounding, both in an aesthetic and useful manner. One of his recent projects is the design of a rose garden, with roses donated by the Hungarian Embassy in Stockholm.

Together with Asmussen, Klingborg is responsible for the placement of the building in the community. Each building is placed to reflect the character of the surrounding landscape. Some wrap around large rock escarpments coming out to the fields, while others stay low to the ground, similar to the concept of Frank Lloyd Wright's prairie buildings. Klingborg is constantly experimenting with gardens throughout the community. For example, he has designed vegetable gardens where unemployed people can come to train as gardeners. The plants from the medicinal gardens are used in the anthroposophical hospital in Järna. Perhaps his most interesting garden is the sewage treatment plant.

Wastewater Treatment and Sewage Reclamation

A significant ecological innovation is in the treatment of the sewage. The wastewater and sewage from the community progresses through vegetated retention ponds (Fig. 2.27). These ponds treat the waste biologically before it enters into the Baltic Sea. Water advances through a series of "flowforms" oxygenating the water. In the early 1970s, the artists John Wilkes, of England, and Arne Klingborg created these treatment plants as an alternative to conventional sewage treatment. They devised a system that uses plants to break down and stabilize organic wastes, nutrients, and a variety of compounds that imitate the process of natural ecosystems. The roots of these plants assimilate the sewage as nutrients feeding their own biomass. And when the wastes are slowed down and retained in these ponds, there is time for the sediments to fall out. The process is one of regeneration, and the product is clean before entering the natural system. In addition to cleaning the water, the ponds and streams serve as pleasant gardens providing an attractive outdoor amenity to the people of the community.

Figure 4.27: Biological sewage treatment system with "flow forms" sited in a sculpture garden. Right: sketch of "flow forms" with Asmussen's office in the background (from Brunyard, 1978 in Hough, 1984).

In Järna, the term wastewater has little meaning. Gardeners now experiment by treating wastewater runoff by filtering the water through the natural ground covers and porous rocks. The runoff follows natural drainage patterns, replenishing the groundwater and providing water to native plants. This process takes advantage of the natural systems and benefits the local environment, as well as saving the community money that would otherwise be utilised for expensive infrastructure projects.

Final Remarks

In summary, the overall impression is that Järna is a community with an organic, stimulating and innovative form of Nordic architecture. The community is a reflection of the anthroposophic movement's dedication to the conservation of the natural environment and to the education and evolution of its members. The 35 years of existence substantiates its success, if one considers longevity and growth a measurement viable community design.

5

Observations

Introduction

The previous chapter described how designers can create communities that have less impact on the natural environment, and demonstrated that practical alternatives to conventional community design do exist. This chapter offers suggestions to community designers, which are based upon observations and the literature of built ecological communities in Northern Europe. I hope that these suggestions may assist community designers and help them avoid common mistakes on similar projects. The suggestions may shorten the time designers require to transfer their ideas from theory into practice. They are not necessarily definitive. Each community will have its own specific ecosystem and, moreover, a totally different set of residents.

5.1 Monitor Input and Output of Community Resources

In all five communities residents are generally aware of the amount of waste materials, energy, and resources they create, produce, and utilize. The understanding of the input and output of resources is significant for establishing a circular metabolism and assisting residents to attain their goal of an ecological community. Residents can point to areas of the community that need improvement or help establish circular metabolism. Monitoring becomes an educational tool that enables residents to learn how their homes and community are connected to a much larger system. This assists residents to conceptualize a circular metabolism.

The following, from the case studies, are some examples of monitoring practices in place. First, residents at Vallersund Gård monitor the amount of energy produced and utilized by the community's windmill. Second, residents at Järna are aware of the amount and quality of effluent being treated by their biological wastewater treatment ponds. They avoid flushing plastic and other artificial objects down the toilet because they have learned and seen the consequences of these actions. All the communities in this study know the estimated amount of solid waste produced by and leaving the community. Third, most of the communities monitor their water consumption levels, and they know when and how they reduce their water consumption. Through an understanding of these figures residents can take action to lessen environmental impacts and save money spent on excess water, energy, and waste handling.

Knowing the numbers of input and output of resources is crucial for change of political and public opinion. Knowledge of such numbers as energy savings, waste reduction, and water conservation, equips residents with facts that prove the viability of their ecological community. For example, as mentioned in the review of the Kassel, Germany project, residents reduced solid waste by 50%, and were then able to convince authorities to reduce waste collection fees also by 50%. Basically, numbers make it easier for the public and politician to visualize the efficiency of ecological communities.

5.2 Involve the Community

Community involvement in the design and development of ecological communities is crucial, yet it is difficult to measure the quantitative and qualitative benefits. The highly acclaimed Brundtland Report, *Our Common Future* (1987), stressed that the autonomy of decision-making and implementation at the local level is a key component for the conservation of natural environments. Community groups provide insight into local ecological and social opportunities and constraints that might otherwise be overlooked by architects and designers. Residents can offer first-hand solutions rather than acting as obstacles to the design of the community. In addition, residents can enhance community support for ecological concerns, and use their position as a mechanism for influencing continued environmental stewardship and motivation in the community.

In almost all the communities studied, residents are involved in major decisions concerning the design, management, or construction process. As a consequence, they understand their local environment. The community can create a design they are comfortable with, and change the design as their needs evolve. Through this understanding the overall design reflects the needs of the community instead of pre-conceived design solutions imposed by outsiders.

In some cases, communities may have residents with certain expertise who could share their knowledge and perhaps give strength to the community's ideas (Perks and Van Vliet, 1993). In this case, residents can reduce expenditures and utilize the extra money for other projects Closer observation of budgets forces residents to use their resources wisely, which often leads to creative and simple solutions. By using community resources, residents can also save time and become more self-sufficient. According to community architect John Turner, people can build their communities more effectively than any professional. He puts it this way:

> The reason the local people build and manage better than either the state or the market has to do with insider information. People are experts on their own situation and since knowledge is power; this is an invaluable resource. So the power they have to make use of their resources at the local level—resources of time and space—is maximized if they can carry out the task themselves (in Kemeny 1989: 157).

As a direct result of community involvement, residents experience more opportunities to get to know one another, which increases community stability. For example, community gardening, self-help building projects, and meetings provide forums for casual community interaction, thus opportunities to develop friendships. These activities generate a place where residents can strengthen the feeling of community. Increased isolation in conventional communities has long been regarded as a contributing factor to the lack of environmental stewardship in contemporary society (Hough, 1993).

Since the communities are able to make design, management, and construction decisions, residents respect and conserve the local environment because they have a vested interest in ecological protection. Topics of ecology are no longer abstract, but directly connected to the results of the decision-making process. After all, each community has its own unique ecology and subsequently requires unique design solutions. With community involvement, designs are more likely to correspond to local ecological needs. Without community involvement, environmental protection will be impossible (Agarwal and Narain, 1989).

5.3 Employ Alternative Housing Arrangements

The ecological communities studied consider the single-family detached house as anti-ecological. As a result they explore other housing forms. In the communities studied, the dominant housing includes multi-family and cooperative housing arrangements. Cooperative housing in particular provides many properties that comply with the principles of ecological communities outlined in Chapter Three. Cooperative housing is conducive to many environmental community technologies (eg. combined heat and power schemes and windmills) that in the case of single-detached houses would require excessive amounts of energy and capital. Furthermore, residents of cooperative housing share appliances, tools, and automobiles to minimize consumption levels. As well, residents can share maintenance activities, which reduces expenses and may increase leisure time.

Cooperative housing, cluster housing, and higher densities create a number of environmental benefits. These density alternatives reduce urban sprawl as well as car-dependency. They reduce distances to mass transit and, in turn, may increase pedestrian and bicycle traffic. Higher densities shorten travel distances for community services, including transporting children to school, removing waste and snow, and accessing public transport. Tighter arrangements of housing reserves land for gardening, play areas, and for the natural treatment of wastewater and storm water. The reduced space facilitates the conservation of environmentally sensitive areas that may otherwise be consumed by inefficient land uses. As well as contributing to environmental protection, these housing forms frequently increase the availability of affordable housing.

5.4 Design for the Pedestrian

A community designed for the pedestrian helps conserve the surrounding environment. All the communities in this study have been designed for the pedestrian, while the automobile received a lesser priority. With fewer roads in the community, more areas can come into use for children. Streets for pedestrians become active places for meeting residents in the community. And less parking and fewer roads make it possible to increase space for housing, parkland, and natural habitats. The benefits are evident in all the ecological communities visited for this study. A close comparison of site plans with those of conventional communities will confirm that ecological communities devote much less land to the automobile in every case.

While living without an automobile is almost impossible in contemporary society, residents of these ecological communities attempt to reduce auto-dependency and use the car as a tool. The communities studied have various methods in which they reduce car-dependency. First, Steyerberg, Germany, Vallersund Gård, Norway, and Järna, Sweden, share cars among residents. They reserve the designated automobiles in advance, as well as group all of their chores into one or two days a week, so as to reduce the need for unnecessary auto trips. The booking system caters to car-pooling as well. Second, all the communities have access to public transportation. Third, residents in Kassel, Germany own their cars independently, but the car stays outside the community. The result for Kassel is an auto-free community; the ideal for all five of the ecological communities.

The design of Ecolonia, The Netherlands, controls and slows traffic. The designer, Lucien Kroll, employs the Dutch *woonerf* (living yard) in which the design of the road slows traffic to speeds between 10-15 kph. The woonerf includes changes such as speedbumps and signs at the entrance reminding drivers that they are entering a controlled traffic zone. In many cases, designers place planter boxes or trees in the street to force cars to slow down. The differences from conventional street design are minimal and without great impositions to the driver. The changes, however, allow greater access for pedestrians and cyclists, as the expectations of the driver change.

5.5 Include Natural Areas into the Community

Many of the community designs in this study include nature within their boundaries. This nature is without disturbance from construction and other human interference. The presence of natural areas allows people to experience, observe, and understand the cyclic processes of nature.

This understanding can foster a greater appreciation of natural areas, whereas biologically sterile landscapes found in conventional communities do not provide the same experience. The absence of nature lessens people's perception and appreciation of natural processes. The consequences lead to the loss of sensual perceptions, loss of orientation and loss of identification (Hahn and Simonis, 1991). The presence of nature can, however, achieve the opposite.

In conventional communities, designers often place natural areas at the edges of the community. This is the result of the single-use zoning practices discussed in Chapter Two. Like everything else in conventional communities, nature has also become a destination. When people wish to experience nature they are often required to travel long distances, thus requiring the use of an automobile. As a result, this travel distance limits the number of times a person can experience a natural area, wastes energy in the form of gasoline, and leaves people without access to an automobile at a loss. Furthermore, Hough (1991) warns that the absence of nature can put environmentalists at a disadvantage. He argues that the perception of human settlements as separate from nature has long been a central problem for the environmental movement and for environmental thinking.

5.6 Challenge the Myth of a Technological Reliance

Considerable debate focuses on whether technology can solve many of the problems in the relationship between ecology and community design. On the one hand, some scientists and designers have complete faith that technology will be the cure of all environmental problems. On the other, many scientists and designers are convinced that technology is the central reason why our society is experiencing an environmental crisis. Among the ecological communities in this study, most of their residents and designers favour the latter argument. In his detailed article entitled "Technology and Our Society", Canadian ecologist David Suzuki (1992) warns that science can only provide a technological fix, and will take upwards to 75 years to find the answers surrounding the conservation of the environment. Suzuki says, "by the time science solves all the problems, we will all be statistics" (1992: 15) Using a similar but more direct analogy, Fisher (1991: 7) writes, "just as methadone is only a palliative to heroin addiction, the technological 'fixes' leave intact our seemingly unlimited craving for finite and increasingly vulnerable supply of oil"

The consensus among the ecological communities studied was to avoid these fixes and reliance on non-renewable resources. They did not reject all technologies. Windmills, solar power, and biological wastewater treatments are examples of some beneficial technologies that met the communities' needs without depleting the earth's finite resources. These communities attempt to use only technologies that are less dependent on fossil fuels and take advantage of renewable energy sources. Architects Doris and Manfred Hegger of the Kassel project advocate and employ these technologies. They argue that technologies in Kassel are environmentally benign, based upon renewable energy sources, low tech, and help increase the self-sufficiency of the community. Residents can easily understand the function of these technologies and perform much of the maintenance themselves.

Other designers of the ecological communities studied the environmental appropriateness of technologies and building products. They researched everything from the origin of the product, life-cycle costs, to embodied energy in the material. Thorough research alerted them to the constraints and limitation of available products. Through processes such as these, designers can attain an understanding of the environmental effects of various products, avoid destructive technologies and play a role in addressing environmental issues.

5.7 Use Experimental Projects to Induce the Gradual Change of Opinion

Many of the communities in this study are experimental and recognize that standardized solutions outlined by government agencies cannot fulfil the needs and desires for those with a commitment to ecological living (Hagen and Rose, 1989). Residents and designers of ecological communities suggest that experimental projects induce learning, encourage innovative thinking, and provide flexible opportunities to test new ideas. The general public understand models, especially working ones, better than concepts. As well, a built example is influential because lessons from experimentation can be employed and improved for future projects, thus contributing to the evolution of good design.

Perks and Van Vliet (1993) claim that experimental projects have tremendous influence in bringing about changes in design and the private sector. They argue that experimental projects provide real examples that persuade the public and local authorities about the richness of ecologically sensitive living environments. Moreover, Perks and Van Vliet found that experimental projects assist in creating new housing markets as developers begin to show more interest in ecological communities. This argument holds true for most of the communities studied in this thesis. For example, in the Kassel, Germany, project, grass roofs were used for the first time in the city, in addition to the reuse of grey water for plumbing systems. Today, these two practices are widely employed throughout the city. The same holds true for Järna, where 30 years ago many of the experiments conducted by the architect Erik Asmussen were viewed with scepticism and sometimes opposition by government officials. Now the architecture and design professions praise the work of Asmussen and regard him as a pioneer in the field of ecologically responsible architecture. In a summary of their research, Perks and Van Vliet discovered through extensive field research and interviews that experimental projects are considered essential for ecologically responsible community design to become mainstream and a public preference.

In their research on "Experimental Programmes as a Tool for Public Policy Formation in Norway", Hagen and Rose (1989) argue that experimental projects are invaluable to the evolution of new concepts. They suggest experimental projects often display honest and less distorted results than theoretical or private-sector studies. Officials often have biases and distort self-assessed reports in an attempt to formulate findings that are better on paper than in reality. Hagen and Rose found that this is not necessarily the case for experimental projects because two primary factors downplay these temptations. They write:

> First, experimental policy programmes, by virtue of their nature, can more readily fail without the same loss of face or prestige as may beset other policy efforts in which clearcut expectations are associated with the outcome. Experimental programmes are, after all, based on trial and error logic and promise no specific results. Second, we are asked to what extent the *effects reported could be documented*, an item that was in part designed to cause second thoughts about presenting an overly "rosy" picture of the world. Responses to this question and follow-up investigations on our part serve to verify that ministry representatives have been fairly objective in what they

reported (1989: 25-6).

The first factor is legitimate. Yet some would argue that the second assumption is based upon too much trust. Furthermore, researchers will sometimes distort findings to benefit themselves. Hagen and Rose indicate that experimentation results become more credible when governments hold regular contact meetings, appoint representatives to the projects, and submit progress reports during the development of the project. In other words, the success of the project and opportunities for learning increase correspondingly to the amount of motivation and organizational measures that local governments provide.

In short, experimentation can guide the way for fulfilment of new ideas and the enrichment of community design. These communities point to a number of ways in which experimentation can achieve a more ecologically responsible practice of community design. First, experimental projects assist in overcoming barriers to ecological community design because they require the necessary organization to follow through procedures needed for the design and construction of viable ecological communities. Second, architecture and design students are given an opportunity to analyze a built example of what ecological communities are, and take this experience into consideration when practising. Third, experimental projects objectively test responses to environmental, social, and economic needs. The experimental projects provide options before making choices that have repercussions detrimental to the expansion of the concept of ecological community design.

5.8 Change the Role of the Community Designer

In the last 10 years, particularly in the last three to five, the community designer has been challenged to define his or her place in society. At the 1992 National Symposium of the Royal Architectural Institute of Canada, *Architecture and the Environment*, many of the papers and presentations focused on the future role of the profession and the role architects could choose to pursue. For example, Bob Berkebile, Chairman of the AIA Committee on the Environment (COTE) presented a lecture entitled, "Architecture: The Endangered Profession". Berkebile warned that if the profession of architecture does not address environmental issues, it runs the risk of becoming irrelevant, dealing only with subjects of no concern to the public. It is becoming evident that environmental issues must become the number-one responsibility for the architecture and community design profession, starting now and continuing into the future. Yet the question remains: how can architects and community designers adapt to the changing needs of their profession and to the needs of society? Just how this change will occur is still subject to debate.

Complicating the changing role is that many of the solutions to environmental problems adds to the numerous tasks a designer has to deal with in everyday practice. In order to make any positive changes, designers must first assimilate more information, and the change may be overwhelming. Alden-Branch (1993: 79) notes that many projects are being managed by designers who "assemble and lead teams of experts, including urban designers, material consultants, waste consultants, and others". Maxim (1993) predicts that the designer will be more of a team leader and a generalist. Likewise, Turner (in Kemeny 1989) calls for "professional entablement" where the designer can bring forth specialized skills for the community to capitalize on. In this manner the designer's outside knowledge can be combined with the community's insider knowledge to create a community that best suits all needs and desires. According to these assumptions, the success of ecological community design lies in a shift towards an integrated team approach.

Other designers believe that solving problems on a much smaller or intimate scale and assuming an active role in the design and construction process will make the greatest difference. Many of the designers of the ecological communities studied in Chapter Four have submerged themselves in the community design by becoming residents (eg. Declan and Margrit Kennedy in Lebensgarten, Germany; Gernot Minke and Doris and Manfred Hegger in Kassel, Germany; and, Erik Asmussen in Järna, Sweden). They argue that the design and construction processes have been separated and that many good design intentions are sometimes ignored or never implemented. Designers commonly avoid the site because if they overlook mistakes they are often held accountable for the problems that arise. Arguably, this is a primary reason for environmental destruction on a construction site. The designers living in the ecological communities studied cannot avoid the site. Since the project is their home, they have a vested interest in conserving the local ecosystems and educating other residents. During site construction designers are able to meet frequently to discuss the preservation of the site. These designers are then able to minimize the damage more easily and set precedents for others to follow. It is evident to these designers that the organization of and involvement in the building process becomes the secret to minimizing the impact on the natural environment.

The 1991 editor of *The Canadian Architect*, Mark Franklin, lists a number of changes a designers can initiate (Farr, 1991). First, they can practise what they preach by ensuring that their own office and community reflect environmental awareness. Second, under their own initiative, designers, along with other consultants, can begin to custom design solutions to many environmental problems, instead of waiting for suppliers to provide them with solutions. Third, Franklin recommends that designers inform their clients of the benefits of ecologically sensitive material and construction processes. Essentially, by educating the client (community residents), more of the general public become informed about environmental issues.

Many of these changes discussed thus far must be initiated by the designer in his or her own particular practice. Keeping abreast of the issues and topics will certainly be a step in the right direction. However, these steps require hard work, more conscious decisions, and especially challenging the business-as-usual techniques. Turner (in Kemeny 1989: 163) suggests that the largest challenge requires the community designer to adopt a more humble role, "...not pretending to know everything because they feel insecure and so become authoritarian. Instead the relationship should be much more cooperative and so likely to produce good results".

5.9 Plan in Stages and for the Long Term

Many of the ecological communities in this study adopt a comfortable pace of development consisting of a series of stages to be implemented over the years. Arguably, in these countries people move less frequently than Canadians, making planning for the long term permissive. In Canada, it is common for people to make many household moves in a single lifetime. The designers and residents believe that overexertion contributes to an exhaustion of physical, emotional and financial resources. They also believe that moving too slowly causes them to become overly theoretical without accomplishing anything of significance. Most have set flexible time limits to meet their objectives helping them to eventually attain their goal of an ecological community.

It is often frustrating for designers to plan for the long term. Designers are concerned with the future, and may want to rush their visions quickly into reality so they can test their ideas. For the community, however, the process of design and construction is perhaps more important than the final product. During the design and construction process people build a sense of community and develop relationships. Therefore, the community is best designed and built over a series of stages. Developing in a series of stages may allow the residents to revisit their initial design assumptions and intentions. They can change the community plan to adapt to their increased understanding of the local ecologies, to the lessons gained in the initial stages, and to their evolving community identity. Thus, the community more closely fits the needs and desires of the residents.

5.10 Share Information Resources

Many ecological communities have a multitude of factors in common. Designers planning to create ecological communities may want to re-invent the wheel, despite the increasing amount of research and practice concerning ecological community design available. The problem, however, is that this information is scattered and hard to access. Setting up organizations to disseminate information can speed up the process of development and help communities avoid mistakes that may have already been made by other communities. These organizations serve to disseminate information across a greater area, causing these once alternative design ideas to permeate into mainstream design practices. It is surprising how effective information exchange can be for the success of an idea.

Among the communities discussed in Chapter Four, many associate themselves with a larger organization. Lebensgarten, Germany is a member of Ökodorf - Informationen (Ecological Villages/Communities - Information), an organization that publishes a magazine every two months on information pertaining to ecological communities around Europe. Vallersund Gård in Norway belongs to the Camphill movement, which has 5 other communities in Norway and upwards of 80 communities in more than 18 countries around the world. As well, many of the Northern European countries have ecological community organisations to assist the development of more ecological communities. Norway and Sweden have the Eco-community Programs and Denmark has a Green Community Projects started in 1986, 1990, and 1989 respectively. They all have the aim to develop strategies for participating ecological communities, and to serve as examples for other communities.

Central organization can produce a forum where communities with similar interests learn from each other's successes as well as the inevitable failures. Institutional methods can be transferred from one community to another. Perhaps most importantly, the communities can benefit from the shared support, especially in times of need. Central organizations can also represent smaller communities on a much larger scale, protect their interests, and extend their influence (Shenker, 1986). McLaughlin and Davidson found:

> In our experience, networking among communities has been very helpful in learning from each others' experiences. There is a greater strength which results when each community realizes it is not alone in trying to create something new, but others are doing related work and there can be a sense of support and cooperation (1985: 340).

In Canada, communities are beginning to set up organizations that one day may lead the way to an ecologically responsible future. The Canadian Healthy Communities movement has begun to make positive results since its inception in 1988 with the support of Health and Welfare Canada and the Canadian Institute of Planners. More than 200 communities have involved themselves with the Healthy Community movement, with 120 participants in British Columbia, 92 in Quebec, and 15 in Ontario. The Clean Nova Scotia Foundation administers an EnviroTowns program to promote environmental awareness in communities throughout Nova Scotia. These organisations avoid giving funding, but instead train local residents on topics of waste management, conservation, and other environmental stewardship practices. The hope is that local residents change their attitudes towards their surrounding environment and stewardship increases. Each organization encourages the exchange of information, acts as a resource base, and offers professional advice directly to interested communities. Annual conferences unite communities involved and consequently increase the amount of interest and energy.

5.11 Maintain a Balance

The final lesson combines all the observations listed. This observation involves a misconception many designers often have when they design for single-purpose solutions. Ecological communities can be mistakenly designed with, for example, only alternative energy systems or some other ecological feature in mind, neglecting such important aspects as community, economics, and lifestyle. Critics suggest that this single-purpose thinking is the reason the modern architecture and planning movement has created so many problems. Bucht (1991) suggests that many ecological communities in Scandinavia may unfortunately suffer the same result by not approaching community design in a holistic manner. He argues:

> ...there are many more examples of negative consequences of such a one-sided ecological design. The problem is that certain ecological criteria are allowed to dominate design and deprive it of the basic principle of good urban planning and design, comprehensive thinking. Therefore I view all ecological architecture and ecological design with scepticism (1991: 101).

Ecology can undoubtedly become the cornerstone of the community, but ecological responsibility is by no means a single remedy for success. Too much devotion to ecological issues may neglect the very residents who are needed for the persistence of the community. It is possible that focusing only on ecology may shun the human aspect, which was the reason why the community was constructed in the first place. It is appropriate to establish well-rounded ecological communities, with all aspects of design integrated. In short, it is the combination of the principles of ecological communities, transportation, and the concentration on community that is decisive in the creation of viable ecological communities. Many of these communities prove that it is possible to support a number of interests all in one design.

6

Epilogue

I will close this study by presenting two conclusions that I consider essential for the transition of the concept of ecological community design from theory into practice. These final points may help bridge the gap between the subjects of ecology and community design. They are also assumptions that may only be proven correct in the coming years.

First, there have been few instances in the literature where authors criticize the intentions of ecological communities. It has been said that an argument against environmentalism is an argument against "mother nature"; an argument few people are willing to make. Nevertheless, critics suggest that the new movement of ecological communities cannot fully address the problems concerning the relation of ecology and community design. The primary argument against contemporary ecological community design concerns the rural character and location of these communities. For this reason, the new concept of ecological communities may not offer solutions to contemporary community design problems. Referring to ecological communities as a phenomenon outside normal planning procedures, Peter Næss writes:

> The culture radical planning ideal may imply some kind of "escapism", as ecologically and politically conscious members of the subculture turn their backs on the city, in order to set up self-governed "eco-villages". For residents of these villages, local environmental concerns are quite certainly taken care of in an excellent way. (In addition, villages are often located in picturesque surroundings.) But what does such a "flight to the countryside" mean to the rest of the population? If the most environmentally conscious part of the population moves, fewer people will be left to defend local environmental qualities for the majority which after all continues to live in the city (1994: 161).

I firmly believe that in order for ecological communities to make an impact on current environmental problems, these communities must be able to transfer to existing urban areas in addition to rural areas. Cities can be seen as a salvation for solving ecological and community design issues, but have been viewed by the public as anti-ecological. This conclusion, it may be argued, is not surprising. The literature is filled with examples proving that cities can easily adopt stronger ecological principles (Berg, 1989; Girardet, 1993; Gordon, 1990; Hough, 1984; Register, 1987, among others). They argue that the city best represents the relationship between the artificial and the natural environments, and is the place where humans consume large amounts of resources, invent new technologies, affect popular culture, and constitute the largest segment of the world's present and future populations. The actions of cities have implications well beyond their own bioregions. As well, in the city it is possible to live without an automobile, thus minimizing the environmental problems associated with the automobile. For these reasons alone, the city presents the most appropriate place to begin solving current environmental problems.

In Northern European countries, particularly Denmark and Germany, many of the ecological projects are in cities. Designers devise efforts to restructure existing urban environments. Under the title urban ecologists, these people assist grassroots organizations and governments in changing the living environments and environmental values of city dwellers. Projects include retro-fitting buildings with environmental technologies, lobbying for more efficient transport systems, implementing waste management programs, and converting grey areas to green spaces. In Germany, these actions have been cunningly called "gentle urban renewal". The urban ecologists have found that their activities have increased community morale, reduced waste costs, created local jobs, and improved the vitality of the respective communities.

Rural areas are, however, places where pioneers in ecological community design can more easily proceed with little interference from the outside world. In the countryside, residents can escape the consumptive attitudes that prevail in urban areas. Furthermore, rural residents have more opportunities to have contact with the land and have a first-hand understanding of local ecosystems. McLaughlin and Davidson (1985) suggest the follow reason why people more commonly begin alternative communities in rural areas:

> ...a certain degree of isolation from dependence upon old patterns of living facilitates the creation of new ones. Urban settings tend to disperse the shared focus of a groups as members get pulled in many directions by all the options available, and old pattern get reinforced. A rural location helps to overcome this, but it's not absolutely essential (1985: 293).

I believe, however, that the urban-versus-rural dichotomy is not particularly important in solving environmental problems related to the creation of human settlements. More importantly, if designers utilize the principles of ecological communities, local ecosystems would stand a better chance of conservation, regardless of the rural or urban location of the community. Bookchin (1980) appropriately argues that:

> Our cities must be decentralized into communities, or eco-communities, exquisitely and artfully tailored to the carrying capacity in the ecosystem which they are located (1980: 42).

From this perspective, cities could slowly evolve in stages from places that at present ignore nature into communities that embrace and recognize the importance of the environment.

For my second and final point, I have come to the conclusion that what the residents and designers of these ecological communities have accomplished is a revival of practical solutions as springboards for elaboration of design ideas for the future. Theorizing may be effective, but at an expense. This may appear hypocritical, but I have realized through my past year of personal research that the profession of architecture and design has a growing collection of theories on ecology and community design in the form of reports, theses and other studies, but few practical solutions. A return to rigorous studies that bridge the gap between theory and practice would be the right balance, and is desperately needed. The residents of these communities have fortunately discovered that by applying practical solutions, they are understanding more about themselves and their environment. Furthermore, they have found that their processes are more efficient than government-imposed solutions that consume time, money, and energy and run the risk of being outdated by the time they are applied. Turner (in Kemeny

1989) urges designers to produce more of what he refers to as "action research". He demands:

> ...research which involves local people and professionals and that finds out how cooperation actually works and what is needed to improve it. Many researchers object to this on the grounds of inefficient detachment and objectivity, but I think that most of us will object to this argument. So, besides the desk work, we must spend some of our time in the field, and we need to alternate between these two activities of desk work and field work. In the field we must test the ideas that we develop at the desk (1989: 163).

When compared with conventional communities—not with perfection or the utopian dream—ecological communities and what they represent can provide designers with potential development alternatives. According to Gilman and Gilman (1991: 10), ecological communities are rare because "these needs and opportunities are so new that we have not yet had the time to adjust to them". But the design profession is now at a crossroads where environmental problems need to be seriously addressed. In this thesis, I have presented a number of alternatives, and even though they may be far from ideal solutions, they have undoubtedly raised the quality of community design in their respective countries. The transition is bound to be demanding. The design of ecological communities will require a number of changes in the development process and, equally important, in people's way of living. The communities reviewed made considerable strides and confronted adverse conditions. These communities have given me a strong image of what people's lives in an ecological community epitomise. Being able to see these examples myself has changed my preference for community design. Furthermore, I am convinced that more public exposure to alternatives design solutions is the first major step toward the liberation of the relationship between ecology and community design. I hope this study shows how ecological communities, in contrast to conventional communities, represent an option for future societies

Appendix A

Resources and Addresses

The following is a list of sources where I sought assistance from for this study. Before visiting any of these people and organizations, I have found it important to call or write beforehand.

Oköstadt (Ecological City)
c/o Dr. Ekhart Hahn
Paul Linke Ufer 30
D-1000 Berlin 36,
Germany

Context Institute
c/o Diane and Robert Gilman
P.O. Box 11470
Bainbridge Island,
Washington, U.S.A.

Gaia Trust
Skyuvej 101
7752 Snedstad,
Denmark

Informationsdienst Ökodorf
(Eco-villages Information Centre)
c/o Karl-Heinz Meyer
Ginsterweg 3
Steyerberg W-3074,
Germany

Urban Ecology
c/o Richard Register
P.O. Box 191444
Berkeley, California
94709, U.S.A.

Vallersund Gård (Case Study)
c/o Gerrit Overweg
Vallersund Gård
7167 Vallersund,
Norway

Järna, Sweden (Case Study)
c/o Erik Asmussen
Rudolph Steiner Seminariet
15391 Järna, Sweden

New Alchemy Institute
237 Hatchville Road East
Falmouth, Massachusetts
02536, U.S.A.

Swedish Council for Building Research
Sankt Göransgatan 66
S-11233 Stockholm
Sweden

EcoDesign
P.O. Box 3981 - Main Post Office
Vancouver, British Columbia
Canada V6B 3Z4

Canada Mortgage and Housing
Research Division
National Office
682 Montreal Road
Ottawa, Ontario
K1A OP7

Gaia Institute
Cathedral of St. John Devine
1047 Amsterdam Avenue
New York, New York
10025, U.S.A.

International Institute for Baulbiologie and Ecology
P.O. Box 387
Clearwater, Florida
34615, U.S.A.

Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass, Colorado
81654, U.S.A.

Econet
3228 Sacramento Street
San Francisco, California
94115, U.S.A.

Alternative Communities Movement
18 Garth Road
Bangor, North Wales
Great Britian

Ecovillage Network
Sztoczek 5-6
H-1111 Budapest,
Hungary

The Ecological Village, Torup
c/o Lief Hierwagen
Solen 3, Torup
3390 Hundsted,
Denmark

Frasenweg, Germany (Case Study)
c/o Doris and Manfred Hegger
Trottstrasse 16
Kassel, Germany

World Health Organization-
Regional Office for Europe
c/o Erlinda Petereson
2100 Copenhagen,
Denmark

International Institute for the Urban Environment
Nickersteeg 5
2611 EK Delft,
The Netherlands

Prof. Hans Loidl, Landscape Architect
Schluterstrasse 19
1000 Berlin 12,
Germany

Steyerberg, Germany (Case Study)
c/o Declan and Margrit Kennedy
Ginsterweg 3
Steyerberg,
Germany

Solar Energy Society of Canada
301 Moody Drive, Suite 420
Neapean, Ontario
K2H OP7

Novem Sittard (Ecolonia)
Swentiboldstraat 21
P.O. Box 17
6130 AA Sittard
The Netherlands

Association to Advance Bicycling
John Gracie, Execrative Director
7013 Pomelo Drive
West Hills, California
91307

Appendix B

Primary Differences Between "Anti-Ecological" and "Ecological" Communities

	Anti-Ecological Communities—linear metabolism	*Ecological Communities—circular metabolism*
Primary Function	Function as linear and mechanical systems that are incompatible with cyclic systems. They take from natural systems at an unprecedented rate, but put nothing back in return	Function as ecosystems in that they establish cycles that conserves natural resources, are self-regulating, and produce little waste
Energy	Rely on non-renewable energy sources (eg. electricity produced from coal and gasoline).	Employ alternative energy systems (eg. solar energy, wind-generated electricity, combined heat and power schemes)
Sewage Treatment	Utilize mechanical sewage treatment systems that transport water quickly though and elaborate, expensive, water consumptive, energy intensive process, sometimes only to dispose raw sewage dangerously into a natural system.	Biological sewage treatment systems that cleanse waste by natural systems. They perceive waste as an "asset". (eg. constructed wetlands, reed beds, and other small-scale sewage treatment systems that utilize environmentally compatible systems)
Water	Rainwater considered as a "refuse". Runoff is treated by mechanical drainage systems, is unfiltered and contains a high concentration of pollutants harmful to sensitive ecosystems.	Rainwater considered as an "asset". Collect water on -site and use it for purposes that do not require high water quality (eg. irrigation and sewage disposal), or let the water filter naturally back into the soil through permeable surface.
Waste Management	Excessively high consumption levels while waste disposal methods are inefficient. Transport waste to overflowing landfills that are growing at and unprecedented rate.	Residents sort, recycle, and compost all "waste" in the community. The goal is to reduce the waste stream of the community.
Housing	Environmentally irresponsible housing that wastes energy, pollutes, and disturbs naturals processes. These houses are made of high resource-consuming building systems and materials.	Composed of environmentally responsible housing that included the use of energy-efficient heating systems, renewable energy technologies, recycled and reused materials, and water-efficient plumbing
Landscape	Biologically sterile landscapes based solely on aesthetics rather than natural functions. Landscapes are often reduced to only a few variety of plants, eliminating the potential for diversity, and requiring an abundance of energy, water, and chemical pesticides to survive.	Naturalized landscapes consisting of a complex biological diversity. They incorporate community farming to lessen the distance of their food has to travel, as well as gaining control over their food source.
Circulation	Designed for the automobile. Streets are noisy, polluted, and, in some places, unbearable for walking. Conducting daily life without the automobile is almost impossible.	Designed for the pedestrian. Fewer automobiles means land that would otherwise be devoted to parks and naturalized spaces is converted to highways and parking lots.
Sense of Community	Disintegration of community. Designs are based on the segregation of members and private rather than common values. They are communities of isolation, rather than communities that reinforce the public domain.	Stresses the importance of community, cooperation, and social investment. Respond to environmental problem solving at the local level and involve the residents

Bibliography

Alden Branch, Mark. "The State of Sustainability", Progressive Architecture. March 1993, pp. 72-79.

Alexander, Christopher, et al., A Pattern Language: Towns, Buildings, Construction. New York: Oxford University Press, 1977.

Amrose, Ivor and Ulf Christiansen (ed). Management and Implementation of Ecological Measures in Human Settlements. A Report for an ECE Research Colloquium in Copenhagen, September 1991. Danish Building Research Institute, Housing and Urban Planning Division, 1991.

Agarwal, Anil and Sunita Narain. Towards Green Villages: A Strategy for Environmentally Sound and Participatory Rural Development. New Delhi, India: Centre for Science and Environment, 1989.

Asmussen, Erik. "For All the Senses - the form language at the Järna Seminary, Sweden", Arkitektur: The Swedish Review of Architecture. June 1984, pp. 8-17.

Bech-Danielson, Claus. "Designed Ecology" DEcon 94 Conference Papers. Baden-Baden, August 17-19, 1994.

Bender, T.. Communities and Social Change. New Jersey: Rutgers University Press, 1978.

Benevelo, Leonardo. The History of the City. Cambridge, Mass.: MIT Press, 1980

Berg, Peter. "A Metamorphosis to Cities: From Grey to Green", Trumpeter. Vol. 8, No.1, Winter 1991, pp. 9-12.

Berger,J.J. Environmental Restoration: Science and Strategies for Restoring the Earth. Washington, D.C. and Covelo, California: Island Press, 1990.

Blundell-Jones, Peter. "Ecolonia", The Architectural Review. Vol.190, March 1992. pp. 64-67.

Bookchin, Murray. Towards an Ecological Society. Montreal and New York: Black Rose Books, 1980.

Bookchin, Murray. Remaking Society. Montreal and New York: Black Rose Books, 1989.

Bookchin, Murray. Urbanization Without Cities: The Rise and Decline of Citizenship.

Montreal and New York: Black Rose Books, 1992.

Brandum, Susan. "Part Two: Lower Energy Costs", Earthkeeper. December/January 1993/1994, pp. 20-27.

Brandum, Susan. "Part Three: The Sins of Their Fathers", Earthkeeper. February/March, 1994, pp. 26-32.

Brandum, Susan. "Part Four: Car Troubles", Earthkeeper. April/May 1994, pp. 22-27

Brandum, Susan. "Part Five: Sustainable Community Design and Telecommuting", Earthkeeper. June/July, 1994, pp. 22-27.

Brown, Bill. "Students Make the Change to a Sustainable Architecture Program", The Journal of the American Institute of Architecture Students. Vol.30, 1993, pp.13-15.

Brown, Lester R. State of the World 1993: A Worldwatch Institute Report on the Progress Toward a Sustainable Society. New York and London: W.W. Norton and Company, 1993.

Brunyard, Peter. "Sewage Treatment in a Swedish Sculpture Garden", The New Ecologist. No.1, January/February 1978, pp.22-23.

Bucht, Eivor. "Green Spaces in Urban Structure" in Management and Implementation of Ecological Measures in Human Settlements. A Report from an ECE Research Colloquium in Copenhagen, September 1991. Amrose, Ivor and Ulf Christiansen (ed.). Published by Danish Building Research Institute Housing and Urban Planning Division. 1991, pp. 97-107.

Cairns, J.J.. Rehabilitating Damaged Ecosystems: Volume 1 and 2. Boca Raton, Florida: CRC Press, 1988.

Calthorpe, Peter. The Next American Metropolis: Ecology, community and the American Dream. New York: Princeton Architectural Press, 1993.

Canada Mortgage and Housing Corporation. "A Socio-Economic Profile of Canadians Experiencing Health of Activity Limitations", Research and Development Highlights Socio-Economic Series. Issue 9, 1992.

Carson, Rachael. The Silent Spring. Houghton Mifflin: Boston, 1962.

Christie, Nils. Beyond Loneliness and Institutions: Communes for Extraordinary People.

Oslo: Norway: Norwegian University Press, Oxford University Press, 1989.

Coates, Gary (ed). Resettling America: Energy, Ecology and Community. Andover, MA. Brick House Publishing, 1981.

Coates, Gary and Susanne Siepl. "Ecological Architecture in the Federal Republic of Germany", in Solar 87: The 12th Passive Solar Conference Proceedings, America Solar Energy Society. Andrejko, Dennis and John Hayes (eds.). Boulder, Colorado, 1987, pp.556-560.

Coates, Gary. "Living Architecture and Community (Järna, Sweden)", Progressive Architecture. Vol.72, March, 1991. p70-73.

Commission of the European Communities, Building 2000. Research and Educational Centre in Steyerberg, Germany. Dordrecht, The Netherlands: EGM Engineering BV, 1989

Commission of the European Communities, Building 2000. Community and EducationalCentre in Steyerberg Germany. Dordrecht, The Netherlands: EGM Engineering BV, 1989.

D'Amour, David. Sustainable Development and the Canadian Housing Sector: Towards and Investigation of Sustainable Housing. Montreal: School of Urban Planning, McGill University, 1990

D'Amour, David. Towards an Investigation in Sustainable Housing. Published by CMHC, 1993.

Day, Christopher. Places of the Soul: Architecture and Environmental Design as a Healing Art. London: The Aquarian Press, 1990.

DeBau '87. "Mehr als Gras und Lehm (More than Grass and Clay)" A profile of the ecological housing project in Kassel, Germany for DeBau '87 conference: Architecture + Nature, 1989.

De Deris-Allen, Joan. Living Buildings: Expressing Fifty Years of Camphill. 1989.

Deelstra, T. et al (eds). Sustainable Cities. Urbanization and the Environment in International Perspective. Boulder: Westview Press, 1992.

Dickinson, Duo. "Prospect: an architect reflects on the environmental challenge of multi-residential design", Landscape Architecture. Vol.81, April, 1991. p.136.

Duany, Andres and Elizabeth Plater-Zyberk. Towns and Townmaking Principles. eds. Krieger, A. and W. Lennertz. New York: Rizzoli, 1991.

Duvall, Bill and George Sessions. Deep Ecology: Living as if Nature Mattered. Salt Lake City Utah: Peregrine Smith Books, 1985.

Eaton, P.B., Hildebrand,L.P., and D'Entremont,A.A. Environmental Quality of the Atlantic Region. Halifax, Nova Scotia, 1985.

Engwicht, David. Reclaiming Our Cities and Town: Better Living With Less Traffic. Philadelphia: New Society Publishers, 1993.

Epp, Eduard. The Arcadian Metropolis: Towards a Sustainable Urban Form. Master of Architecture Thesis. Montreal: McGill University Faculty of Architecture, 1993.

Eriksson, Eva. "Expressionism and Tradition (Järna, Sweden)", Arkitektur: The Swedish Review of Architecture. June, 1994, pp.4-7.

Evans, Angela. "Eco-Living in Sweden: Inspiration for Canadians and Designers", EcoDesign: A Design Journal for Health and the Environment. December, 1994, pp. 27-30.

Fairlie, Simon. "White Satanic Mills", The Ecologist. Vol. 24, No.3, May/June 1994, pp. 85-86.

Farr, Moira. "Architects and The Environment", The Canadian Architect. Vol. 36, April 1991, pp. 20-22.

Fisher, Thomas. "Our Oil Addiction: an Editorial", Progressive Architecture. March 199, p.7.

Forman, R.T.T., and M. Godron. Landscape Ecology. New York: John Wiley and Sons, 1986.

Forsey, Helen (ed.). Circles of Strength: Community Alternatives to Alienation. New Society, 1993.

Francis, Mark and Randy Hester (eds.). The Meanings of Gardens. MIT Press: Cambridge, Mass., 1990.

Franck, Karen. New Households, New Housing. New York: Van Nostrand Reinhold, 1989.

Gans, Herbert. The Urban Villagers. New York: Free Press of Glencoe, 1962

Gilman, Robert. "The Eco-Village Challenge", In Context. No. 29, Summer 199, pp. 10-15.

Gilman, Diane and Robert Gilman (ed). Eco-Villages and Sustainable Communities. Context Institute: Bainbridge Island, Washington, 1991.

Gillette, Becky. "Natural Systems: The Green Revolution in Wastewater Treatment", Biocycle: Journal of Composting and Recycling. December 1992, pp. 44-48.

Girardet, Herbert. The Gaia Atlas of Cities: New Directions for Sustainable Urban Living. New York: Anchor Books, Doubleday, 1993.

Gordon, David. Green Cities: Ecologically Sound Approaches to Urban Space. Montreal/New York: Black Rose Books, 1990.

Gordon, Clive. "Sustainable Landscapes", Landscape Design. May 1991, pp.47-49.

Grant, Jill et al. Sustainable Development in Residential Land Use Planning. Ottawa: CMHC, 1993.

Green, D. "CHP—Europe's Opportunity", European Environment. Vol.3, 1991, p.16.

Hagen and Rose. "Learning by Doing? Experimental Programmes as a Tool for Public Policy Formation in Norway", Scandinavian Housing and Planning Research. No. 6, 1989, pp. 17-30.

Hahn, Ekhart. Siedlungsökologie. Karlsruhe, Germany: Verlag C.F. Müllller, 1988

Hahn, Ekhart and Udo E. Simonis. "Ecological Urban Restructuring" in Ekistics. 348, May/June, 1991. pp.199-209.

Hardy, D. Alternative Communities in Nineteenth Century England. London: Longman, 1979.

Hawkens, Paul. The Ecology of Commerce: A Declaration of Sustainability. Harper Collins, 1994.

Hayden, D. Seven American Utopias. Cambridge: MIT Press, 1976.

Hayden, D. Redesigning the American Dream. New York: W.W. Norton & Company, 1984.

Heinz-Meyer, Karl. Zukunftswerkstatt Gemeinschaftsprojekte (The Future of Working

Community Projects). Lebensgarten in Steyerberg, Germany, 1992.

Hester, "Process can be Style: Participation and Conservation in Landscape Architecture" in Landscape Architecture 73, No.3: 49-55, 1983

Hillary, George A. "Definitions of Community", Rural Sociology. Vol.20, 1955, pp.111-113.

Hough, Michael. Out of Place: Restoring Identity to the Regional Landscape. New Haven and London: Yale University Press, 1990.

Hough, Michael. "Naturalization Parks and Non Park Open Space" in Green Cities: Ecological Sound Approaches to Urban Space, edited by David Gordon. Montreal and New York Black Rose Books, 1993. pp.93-99.

In Practice. Practice Alternatives by Local Authorities in Scandinavia. Oslo, July 1991.

Ingersoll, Richard. "The Ecology Question", Journal of Architecture Education. Vol.45, February, 1992. pp.125-127.

Jacobs, Jane. The Death and Life of Great American Cities. New York: Random House Press, 1961.

Jacobs, Peter. "A Sustainable Society Through Sustainable Development: Towards a Regional Development Strategy for Northern Quebec", Landscape Planning. Vol. 12, 1985, pp. 267-283.

Jacobs, Peter. "Achieving Sustainable Development", Landscape Planning. Vol.12, 1985, pp.203-209.

Jordon, W.R.III. "Restoration Ecology: A Synthetic Approach to Ecological Research." in Rehabilitating Damaged Ecosystems, Edited by Cairns, J.Jr., Vol.1, CRC Press 1988.

Kareoja, Pentti. "360 Degrees of Architecture", The Finnish Review of Architecture. March 1993, p. 15.

Kelbough, Doug (ed.). The Pedestrian Pocket: A New Suburban Design Strategy. New York: Princeton Architectural Press, 1989.

Kemeny, Jim. "Community-based Home and Neighbourhood Building: An Interview with John Turner", Scandinavian Housing and Planning Research. No. 6, 1989, pp. 157-164.

Konig, Karl. The Camphill Movement. Botton Village, Danby, North Yorkshire, 1960.

Kozloff, Keith Lee. "Renewable Energy Technology: A Hard Sell an Urgent Need", Environment. Vol. 36, No. 9, November 1994, pp. 4-20.

Krier, Leon. "The Reconstruction of Vernacular Buildings and Classical Architecture", The Architects' Journal. Vol. 180, No. 37, September 12, 1984, pp. 55-84.

Krier, Rob. "Tradition-Modernity-Modernism: Some Necessary Explanations": Architectural Design Profile, 1987.

Lachman, Gary. "Rudolph Steiner", Gnosis Magazine. Fall 1994, pp. 23-27.

Lang,R and Audrey Armour. Environmental Planning Resourcebook. Prepared for the Lands Direcoriate, Environment Canada, Montreal, Canada, 1980.

Latta, Maureen. "CoHousing: Creating Sustainable Neighbourhoods", Earthkeeper. May/June 1994, pp. 36-39.

Leopold, Aldo. The Sand County Almanac. Oxford University Press: New York, 1949.

Lovelock, James. Gaia: A New Look at Life on Earth. Doubleday: New York, 1986.

Lovins, Amory. "Vaulting the Barriers to Green Architecture", Architectural Record. Vol.180, December, 1992. p.16.

Lyle, John T. Design for Human Ecosystems. New York, N.Y.: Van Nostrand Reinhold, 1985

Lyle, John. "Urban Ecosystems: Cities of the future will embrace the ecology of the landscape rather than set themselves apart", IN CONTEXT: Designing a Sustainable Future: Buildings, Neighbourhoods, Cities. No.35, Late Spring 1993, pp. 43-45.

Marsh, G.P. [1864]. Man and Nature, or Physical Geography as Modified by Human Nature. Reprint. ed. D.Lowenthal. Harvard University Press, Cambridge, M.A., 1965

McGlaughlan, C. and G. Davidsion. Builders of the Dawn: Community Lifestyles in a Changing World. Tennessee: Book, 1985.

McGreggor, P.J.W. Approaches to Living Ecologically: A Comparison of Three Intentional Communities in Rural North America. Masters Thesis, School for Resource and Environmental Studies, Dalhousie University, Halifax, Nova Scotia, 1992.

McHarg, Ian. Design with Nature. New York: John Wiley and Sons, Inc., 1967.

McKibben, Bill. The End of Nature. Random House Press: New York, New York, 1989

Molinari, Tamara. "Bio-Building: A Collective Experience (ecological village outside Kassel, Germany), Arbitare. Vol.No.297, June, 1991. pp. 124-133.

Mollison, Bill. Permaculture: A Designer's Manual. Tagari, 1988.

Mumford, Lewis. The City in History: Its Origins, Its Transformations, and Its Prospects. New York: Harcourt Brace Javanovich, 1961.

NRTEE. "Review: Sustainable Communities", National Round Table Review. Spring, 1994.

Næss, Peter. "Normative Planning Theory and Sustainable Development", Scandinavian Housing and Planning Research. Vol. 11, 1994, pp. 145-167.

Næss, Peter. "Environment Protection by Urban Concentration", Scandinavian Housing and Planning Research. No. 6, 1991, pp. 247-252.

Nijkamp, Peter and Adrian Perrels. "Urban Space: A Potential for Sustainable Development, Illustrations from Europe", Environments: A Journal of Interdisciplinary Studies. Vol.22, No.1, 1993, pp.82-88.

Nisbets, R. A. The Sociological Tradition. London: Heinemann, 1970.

Nozick, Marcia. No Place Like Home: Building Sustainable Communities. Canadian Council on Social Development, Ottawa, 1992.

Oates, A. Earth Rising. New York: Doubleday 1989.

Odum, Eugene P. Ecology and Our Endangered Life-Support Systems. Sunderland, Massachusetts: Sinauer Associates, Inc. Publishers, 1983.

Owen, Stephen. Planning Settlements Naturally. Chichester: Packhard Publishing, 1991.

Owen, Susan. Energy Planning and Urban Forms. London: Pion Ltd., 1986.

Pearson, David. The Natural House Book. Simon and Schuster: New York, New York, 1989.

Perks, William and David Van Vliet. Assessment of Built Projects for Sustainable

Communities. Faculty of Environmental Design, The University of Calgargy and Canada Mortgage and Housing Corporation, 1993.

Pelissero, Harry. "Urban Agriculture in the Green City" in Green Cities: Ecologically Sound Approaches to Urban Space, Edited by David Gordon. Montreal and New York: Black Rose Books, 1993 pp.263-267.

Pietzner, Cornelius. Candle on the Hill: The Camphill Communities Worldwide. Edinburgh, 1989

Popenoe, D. The Suburban Environment. Chicago: University of Chicago Press, 1977.

Popenoe, D. Disturbing the Nest: Family Change and Decline in Modern Society. New York: A. de Gruyter, 1988.

RAIC. Architecture and the Environment. Conference Proceeding of the National Symposium in Vancouver, October 1992.

Rees, William. "The Ecology of Sustainable Development", The Ecologist. 20(1), 1989, pp.18-23.

Register, Richard. Ecocity Berkeley: Building Cities for a Healthy Future. Berkeley, California: North Atlantic Books, 1987.

Richardson, Nigel. Land Use Planning and Sustainable Development in Canada. Ottawa: Canadian Environmental Advisory Council, 1989.

Roseland, Mark. Towards Sustainable Communities. National Round Table On the Environment, Ottawa, 1992

Rowe, J. Stan. "Ecology and Architecture: public life based on ecological understanding" in The Structurist. Vol.No.31/32, 1991 and 1992, pp.16-22.

Rudig, W. "Energy Conservation and Electricity Utilities", Energy Policy. Vol. 16, April 1986.

Rybczynski, Witold et al. The Ecol Operation: Ecology + Building + Common Sense. Minimum Cost Housing Group, McGill University, Montreal, Quebec, 1972.

Rydin, Yvonne. "Environmental Dimensions of Residential Development and the Implications for Local Planning Practice", Journal of Environmental Planning and Management. Vol.35, No.1, 1993, pp. 43-61.

Sachs, Wolfgang. "If Wishes Were Horses: Desire and Democracy in the History of Transport", The Ecologist. Vol. 24, No. 23, May/June 1994, pp. 94-99.

Schiefloe, Per Morten. "Networks in Urban Neighbourhoods: Lost, Saved or Liberated Communities", Scandinavian Housing and Planning Research. Vol. 7, 1990, pp 93-103.

Sewell, John. "Alternatives to the Suburbs". The Second City Book: Studies of Urban and Suburban Canada. 1991

Shenker, Barry. Intentional Communities. London: Routledge and Kegan Paul, 1986

Simmonds,John O. Earthscape: A Manual of Environmental Planning. McGraw-Hill Book Company, 1978.

Spencer, Robert. "Greenhouse System: Solar Aquatic Treatment of Septage", Biocycle: Journal of Composting and Recycling. May 1990, pp. 66-70.

Spirn-Whiston, Anne. The Granite Garden: Urban Nature and Human Design. New York: Basic Books Inc., 1983.

Stren, Richards, Rodney White, Joseph Whitney (eds). Sustainable Cities: Urbanization and the Environment in International Perspective. Boulder, San Francisco and Oxford: Westview Press, 1992.

Statistics Canada, Structuralist Analysis Division. Human Activity and the Environment: A Statistical Compendium. Ottawa: Supply and Services, 1989

Stokes (1978) in White, Roger and Joseph Whitney, (eds). Sustainable Cities: Urbanization and the Environment in the International Perspective. Boulder, San Francisco, and Oxford: Westview Press, 1992.

Suzuki, David. "The Limits of Science and the Price of Technology", Trumpeter. 6:1, 1989, pp. 14-16.

Tetlow, Karin. "Healthy Colour (Järna, Sweden)", Interiors. Vol.149, December, 1989. pp.94-97.

Thayer, Robert L. Jr. "The Experience of Sustainable Landscapes", Landscape Journal. Vol.8, No.2, Fall 1989, pp.102-110.

Thein Durning, M. "The Seven Sustainable Wonders of the World", Utne Reader.

March/April 1994, pp. 96-97.

Todd, Nancy Todd and John Todd. Bioshelters, Ocean Arks, City Farming. San Francisco: Sierra Club Books, 1984.

Tokar, B. The Green Alternative: Creating an Ecological Future. California: R & E Miles, 1987.

Tourbier, Toby J. "Ecological Landscape Design", Urban Land Institute. March 1985, pp.104-108.

Turner, John. Housing by People Towards Autonomy in Building Environments. London: Marion Boyars, 1976.

Tyler, Mary-Ellen. "Ecological Plumbing in the 21st Century", Plan Canada. July 1994, pp.169-176

Vale, Brenda and Robert James Vale. Green Architecture: Design for an Energy-conscious Future. Bulfinch Press: Boston, London and Toronto, 1991.

Vale, Brenda and Robert James Dennis. "The Future Development of the Built Environment", Town and Country Planning. Vol. 61, November/December 1992, pp. 296-7.

Van der Ryn, Sym and Peter Calthorpe. Sustainable Communities: A New Design Synthesis for Cities, Suburbs, and Towns. Sierra Club Books: San Francisco, 1986.

Van der Ryn, Sym. "Eco-Villages: Towards Sustainable Architecture", Progressive Architecture. March, 1991, pp.88-90.

Van Vliet, Willem, "The United States", in Sustainable Cities: Urbanization and the Environment in International Perspective, Stren (ed.), 1992, 169-205.

Vikkelso, Ann (ed). The Sustainable Energy Handbook. Published by the Copenhagen Environment and Energy Office and The Danish Organization for Renewable Energy. September 1993.

Walters, Derek. The Feng Shui Handbook: A Practical Guide to Chinese Geomancy and Environmental Harmony. London: The Aquarian Press, 1991.

Watson and Watson. Man and Nature. New York: Doubleday, 1969.

Webb, Richard. "Permaculture in Practice", Landscape Design. September 1993, pp.14-18

Wells, Malcolm. Gentle Architecture. New York: McGraw-Hill Book Company, 1981

WCED. Our Common Future. Oxford and New York: Oxford University Press, 1987

White, Roger and Joseph Whitney. "Cities and the Environment: An Overview" in Sustainable Cities: Urbanization and the Environment in International Perspective. Stren (Ed), 1992. pp.8-53.

Wilson, Alexander. The Culture of Nature: North American Landscapes from Disney to the Exxon Valdez. Toronto: Between the Lines, 1991.

Wines, James. "Green Dreams", Art Forum. Vol.30, No.2, October 1991, pp.82-85.

Yeates, M.. Land in Canada's Urban Heartland. Land Use in Canada Series, No. 27 Environment Canada. Land Directorate, 1985.

Yip, Stanley. "Applying Sustainable Development Principles to Residential Community Planning", Plan Canada. March 1994, pp.31-34.