

**A STUDY OF THE EFFICIENCY AND POTENTIAL OF THE ECO-
VILLAGE AS AN ALTERNATIVE URBAN MODEL**

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**Assignment presented in partial fulfilment of the requirements for the Degree of Master of
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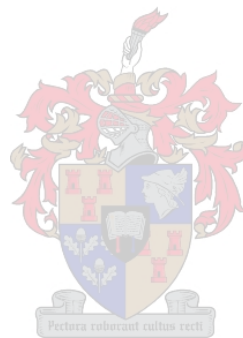
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DECEMBER 2005

DECLARATION

I, the undersigned, hereby declare that the work contained in this assignment is my own original work and has not previously, in its entirety or in part, been submitted at any university for a degree.

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ABSTRACT

It is generally agreed that the concept of sustainability should play an increasing role in future urban development world-wide. In order to ensure ecological sustainability, cities around the world have to decrease their environmental footprint. Two aspects are important in this regard: the decrease of energy consumption and the decrease of waste products and its subsequent management.

South Africa's current reality is one of fragmented cities. Due to its socio-political history, the country suffers a legacy of spatial imbalance and cities that cannot function optimally, both in physical and social terms.

In light of this, it is necessary to look at alternative models of urban settlement that are suited to specific contexts. This study discusses the concept of eco-villages as an alternative urban model and its potential to deal with the physical and social requirements of the current situation. A number of such developments are discussed as examples.

Specific attention is given to the physical considerations necessary in the development of an ecologically-oriented settlement. This includes the general layout, the design and functioning of buildings, sewage and water reticulation systems, recycling of waste products and reciprocal influence of the natural and man-made environments. Reference is also made to the social dimension of such settlements.

The concept of eco-villages, despite having arguably limited influence, does have the potential to serve as an alternative urban model. As relatively small experimental communities, eco-villages are in the position to explore and apply novel solutions, the necessity of which is evident in the global concern for sustainability. Valuable practical lessons can be provided in the current search for suitable urban development.

OPSOMMING

Dit word algemeen aanvaar dat stede oor die wêreld, ten einde hul volhoubaarheid te verseker, na laer ekologiese impak moet streef. Twee doelwitte is veral belangrik in hierdie proses: die vermindering van, die energieverbruik van stede, en die vermindering van stedelike afvalprodukte en die wyse waarop dit bestuur word.

Die realiteit tans is dat stede in Suid-Afrika gefragmenteer is. As gevolg van historiese omstandighede het die land 'n nalatenskap van ruimtelike wanbalans en stede wat nie optimaal kan funksioneer nie, beide in fisiese en sosiale terme.

In die lig van hierdie gegewens is dit nodig om te kyk na nuwe modelle van stedelike nedersettings wat geskik is vir spesifieke kontekste. In hierdie werkstuk word daar gefokus op die verskynsel van eko-dorpe as 'n alternatiewe stedelike moontlikheid en die potensiaal wat dit het om te voldoen aan die fisiese en sosiale eise wat deur huidige toestande vereis word. Daar word gekyk na 'n aantal voorbeelde van sulke ontwikkelings.

As deel van die werkstuk is gekyk word na fisiese aspekte wat in aanmerking geneem moet word in die ontwikkelingsproses van 'n eko-dorp. Dit sluit in: die uitleg, ontwerp en funksionering van geboue, riool- en waterstelsels, herwinning van afval, en die wedersydse invloed van die natuurlike omgewing en die ontwikkeling op mekaar. Daar word ook verwys na die sosiale dimensie van sulke nedersettings.

Die konsep van eko-dorpe, hoewel van beperkte invloed, het wel die potensiaal om as 'n alternatiewe stedelike model te dien. As relatief klein eksperimentele gemeenskappe, het eko-dorpe die vermoë om nuwe oplossings, genoodsaak deur die wêreldwye strewe na volhoubaarheid, te ondersoek en toe te pas. Dit kan waardevolle praktiese lesse meebring in die soeke na gepaste stedelike ontwikkeling vir ons tyd.

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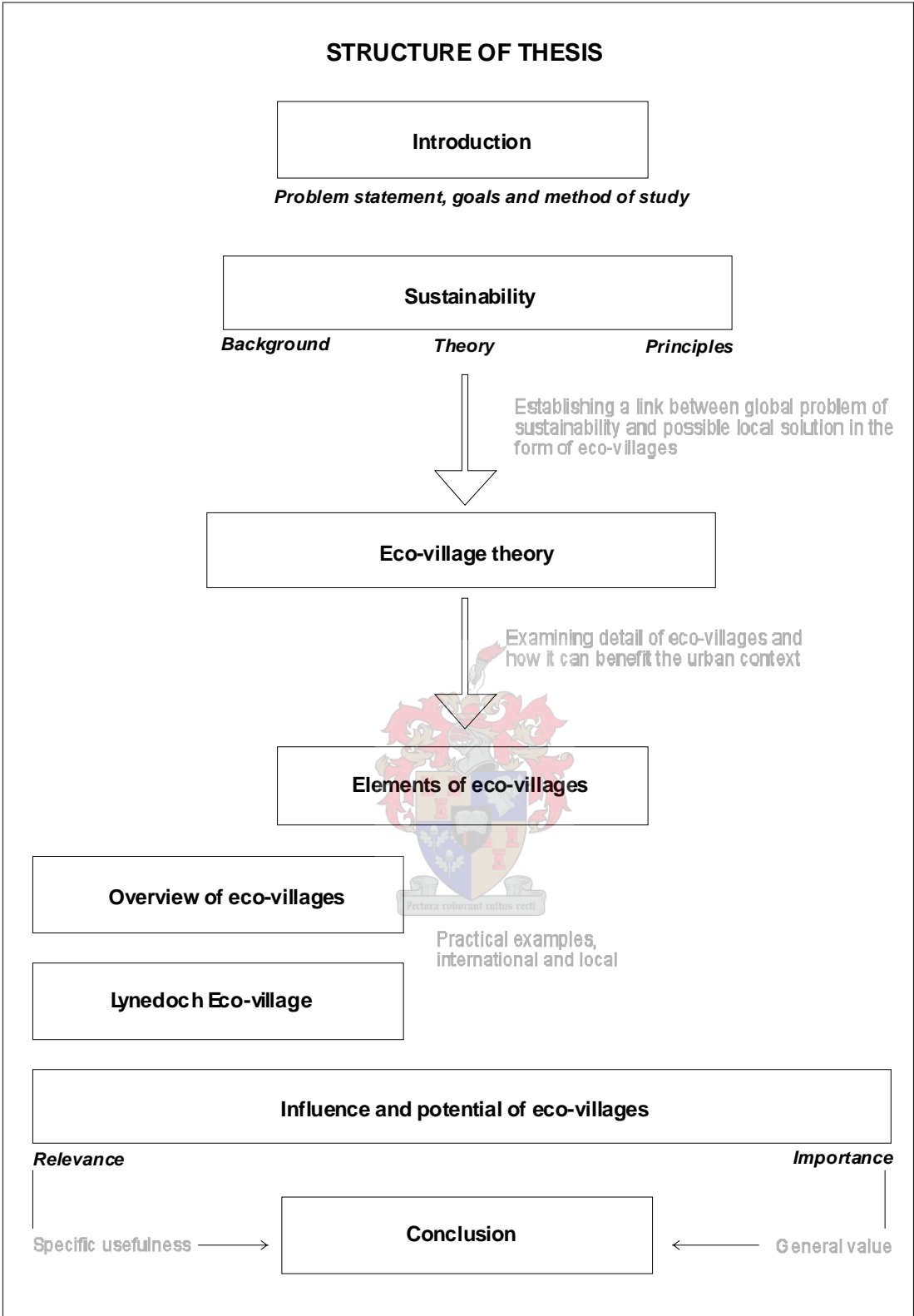


Figure 1:
Diagrammatic structure of study

CHAPTER 1: INTRODUCTION

1.1. BACKGROUND AND PROBLEM STATEMENT

Around the world many cities share similar urban environmental problems. These complex problems are often interlinked with other aspects of the society that inhabits the world. Given this context, this part of the dissertation will focus on sketching the different aspects that inhibits sustainable development in modern cities as well as positive aspects that create opportunities for sustainable development.

According to United Nations estimates, as quoted by Swilling (2004:3), by 2007 half of the world's total population of over 6 billion people will be living in cities. Furthermore by 2050 the world's resources will have to support more than 9 billion people, of which 75% will be living in cities. Urbanisation is not a foreign concept to the development agenda of the world, but the move to cities creates opportunities to commit to a sustainability agenda given that more and more is at stake when the natural environment is not properly cared for.

Swilling (2004:3) highlights four challenges that must be met to ensure sustainable societies:

- Substances produced by nature are to be removed for consumption at a slower rate than at which they are regenerated by the earth's natural systems.
- Substances (mainly wastes) produced by society are to be deposited in natural systems at a slower rate than at nature's capacity to absorb them.
- Ecosystems are not to be degraded or destroyed.
- The fundamental human needs of every individual are to be met, including the need to be healthy, secure and expressive.

In South Africa the segregated cities from the apartheid past provide a favourable breeding ground for economic and social problems. This impacts on environmental problems as systems of sustainable service provision are lacking in large parts of the country. In order to deal with these problems, society has to realign itself according to non-racial norms, which is not a simple task, given the past denial of resources to segments of the population.

It seems that we have approached, if not exceeded, the limit of human activities the earth can sustain. To ensure the continuance of a 'tolerable planet', a new way of dwelling has to be explored. Trainer (2002: 67) argues that such a radically different conception of development and an associated practice are now emerging in rich and poor countries, in response to the failure of conventional development theory and practice. This 'appropriate development' focus is most evident in the global eco-village movement. Around the world

there are now many smaller settlements exploring ways of living cooperatively and with less impact on earth, via simpler lifestyles, more cooperative and participatory systems and small-scale, highly self-sufficient local economies which are not driven exclusively by profit, market forces or growth.

The emergence and growing popularity of eco-villages¹ is a reaction to the consumerist culture of the world. They are concerned with diversity, cultural pluralism, local governance and empowerment. Eco-villages or similar sustainable settlements place special emphasis on contextuality and local action. This study is concerned with the efficiency of such initiatives in dealing on a local level with problems facing humanity as a whole. The potential of the eco-village concept to serve as alternative urban model will be examined together with the influence that these developments might have.

1.2. GOALS

The aim of this study is to investigate the extent to which eco-villages are a sustainable, environmentally- friendly and socially acceptable housing and living alternative. It will explore the question of eco-villages perhaps being a luxury for a fortunate few or a necessary way forward for South African society to deal with the issues of the past and move to a more inclusive, environmentally and economically sustainable society.

The objective of this study is further to examine the occurrence of eco-villages as an efficient response to the environmental and social problems of modern urban living, and to analyse the way in which eco-villages function. By examining the details of eco-villages, the goal is to determine the possible influence of eco-villages and the lessons that can be learned from them.

1.3. METHOD

The study is descriptive in nature and is based primarily on an overview of relevant literature. This is complemented by information gained through discussions and interviews. Lynedoch eco-village is discussed as a case study.

¹ In the literature under discussion, variations of 'eco-village', 'ecovillage' and 'Eco Village' occur. For the purpose of uniformity, the spelling 'eco-village' will be used throughout this document, except where it refers to existing examples that is spelled differently.

CHAPTER 2: SUSTAINABILITY

2.1. BACKGROUND

2.1.1 The increasing role of cities

The world population has been rapidly migrating to cities, especially over the last century, *inter alia* because cities offer better opportunities and living conditions. Cities cover only 2% of the world's surface, although half the world's 6 billion population lives in cities (Gasson 2002:1). Because of the increased wealth, partially created through the efficiency of cities, the average consumption and pollution by people increased rapidly over the last century. This in turn has increased demands on the natural environment, and has consequently decreased sustainability.

Because of increasing urbanisation, it is essential to concentrate on the efforts of cities to improve sustainability. Another important field that needs attention is agricultural production methods, but that will not be addressed in this study.

2.1.2. Increasing global environmental problems

It is widely accepted that cities around the world are making increasing demands on natural resources and energy as populations increase and consumerist culture continues to expand. Many scientists believe that current urban patterns of living cannot be sustained indefinitely, and that cities are facing severe environmental problems in the not so distant future. According to Gasson (2002:1), progress towards environmentally sustainable development focuses attention on cities for two reasons. First, cities are where nearly 50% of the global population of 6 billion already lives and will increasingly live. Second, cities consume 75% of the world's resources and produce 75% of the world's wastes. Due to the growth in population, affluence and urbanisation, these figures are set to rise in the coming decades. So, urban populations are major contributors to resource depletion and environmental degradation even though they only occupy about 2% of the earth's surface (Girardet, 1992). Although Girardet fails to compare per capita consumption and pollution of city and rural dwellers, the fact is that the concentration of people in cities clearly demands concerted efforts to address sustainable living there.

Many of these problems are already evident and are shared by cities around the world irrespective of their level of development. Issues such as waste accumulation, air and water pollution, fossil fuel dependency, and the related questions of urban development, urban

transport, lifestyles, and production structures, which all depend upon the mass consumption of resources and energy, are of concern to those involved in urban administration and development.

There are of course global initiatives to deal with these problems and many strategies have been formulated as part of international environmental agendas. The most obvious of these include the Agenda 21 principles reached during the Rio conference of 1992. However their effectiveness in terms of local urban action is debatable.

2.1.3 Environmental problems

Some of the more widely acknowledged environmental problems of a seemingly endless list, include: the over-consumption of natural resources; the influence of continuing urbanisation; coastal and marine degradation; deforestation; land degradation; population growth and the resulting pressure on food production; the apparent increased occurrence of natural disasters; water shortages; land degradation; shortage of agriculturally fertile soil; unsafe water and sanitation; threatened biodiversity; and the diminishing oil and gas reserves.

The State of the World report by the Worldwatch Institute (2003: 5) discusses five threats that, in its view, are the most serious facing the planet currently.

Population increase

First, the increasing global population implies added pressure on existing natural and capital resources in an effort to provide in the needs of all the people. The global population now exceeds 6,2 billion and is projected to rise to between 7,9 billion and 10,9 billion by 2050. The increase will almost entirely take place in developing countries, which are already experiencing strain on their resources. Almost a quarter of the world's population, 1,2 billion people, that are living in developing countries are classed by the World Bank as living in 'absolute poverty' and has to survive on less than the equivalent of \$1 a day (Worldwatch Institute 2003: 5).

In many countries cropland per capita is no longer sufficient to provide in the nation's need and these countries have to rely on imports. It is estimated that by 2025 the population of countries that must import food could exceed 1 billion. In addition to this the quality of cropland in many countries is declining and yields less due to degradation, which has accelerated over the past 50 years.

However, it is not only the shortage of land, but also the shortage of water that is cause for concern. As the State of the World report (2003: 5) states, there are already more than half a billion people living in regions prone to chronic drought. By 2025 it is possible that this

number will have increased to between 2,4 and 3,4 billion. This is due in part to the current inefficiencies in food and water supply systems, but also worsened by the expected 27% population increase.

Geo-chemical changes

The second global threat relates to certain forms of pollution that are altering the global chemical cycles in key ecosystem processes (Worldwatch Institute 2003: 5). The most prominent example is the carbon cycle. Carbon, that for millions of years have been stored as coal and oil, is now re-injected into the atmosphere. It is feared that the increasing concentration of carbon dioxide can cause rapid climate change because of the way it traps heat. In 2001, annual carbon emissions from fossil fuel combustion reached a record 6,55 billion tons. This level of atmospheric concentration of carbon dioxide (370,9 parts per million), is the highest in 420 000 years, and probably even in 20 million years.

The nitrogen and phosphorus cycles too are influenced by human activities (Worldwatch Institute 2003: 6). Both of these are important regulators of plant growth. Nitrogen becomes biologically available when it is converted from its inert elemental form into molecules also containing hydrogen and oxygen. This natural process can occur through lightning strikes and through the actions of certain soil microbes. However, due to human activities like fertiliser production, fossil fuel combustion and the widespread cultivation of plants in the bean family (which often have nitrogen-fixing microbes on its roots), the rate of fixation of nitrogen into molecules is greatly increased. In addition already-fixed nitrogen is released when forests and wetlands are destroyed. Because of these activities, the annual release of fixed-nitrogen has doubled to 350 million tons.

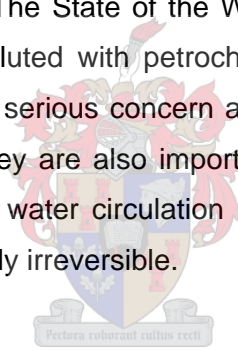
The natural release of phosphorus, from the weathering of rock, is being augmented by mining. Phosphorus is used mainly in fertiliser production. The annual release of phosphorus seems to have increased from its natural rate by a factor of 3,7 to 13 million tons.

As phosphorus and fixed-nitrogen are plant nutrients, their increasing presence is likely to cause widespread ecosystem change. In aquatic ecosystems eutrophication, that is, an excess of nutrients, causes dense algae growth that blocks sunlight and decreases dissolved oxygen levels. On land, an overgrowth of weedy species best equipped to use the excess nutrient, can cause a homogenisation of diverse plant communities. Plant species exposed to higher levels of nutrients are also more prone to disease and insect attack. In certain forms, excess fixed nitrogen is also a major component of acid rain which causes acidification of soil and water. In the long-term, soil exposed to acid rain leaches out the

essential plant nutrients calcium and magnesium, and aluminium is freed from the mineral matrix that keeps it inert. Free aluminium is toxic to plants and aquatic life.

Toxic chemicals

The long-term risks due to toxic chemicals are increasing. According to the State of the World report (2003: 6) a conservative estimate has it that global production of hazardous waste has reached 300 to 500 million tons per year. Depending on the type of waste disposal, it may involve condensing, incineration, recycling, or neutralisation through chemical or biological treatment. The waste may also be injected into deep wells or dumped into landfills, thereby postponing, but not eradicating, the problem. Many major pollutants are not even classified as waste, for example pesticides, the anti-freeze compounds used in the airline industry or the chromated copper arsenate in treated timber. All of these are at some stage entered into the environment, either in their original forms or as their (equally damaging) breakdown products. It is impossible to quantify the chemical changes brought about in the environment due to the actions of man. However it can safely be stated that the impact is severe and still growing. The State of the World Report (2003: 7) states that, for example, aquifers are evidently polluted with petrochemicals, heavy metals, nitrates from fertiliser, and other toxins. This is a serious concern as more than half the volume of lakes and rivers comes from aquifers. They are also important sources of irrigation and drinking water. Because of the slow rate of water circulation in aquifers, complete renewing takes centuries and makes pollution virtually irreversible.



Biotic mixing

A fourth threat is found in the unprecedented degree of biotic mixing that the world is subjected to (Worldwatch Institute 2003: 7). Growing numbers of organisms are moving across the globe and emerging in regions where they are not native. Such invasive exotics may threaten or supplant the indigenous species. Depending on the species, the exotic may out-compete native species for some essential resource, or launch an epidemic, or prey on natives directly. This trend threatens ecosystems.

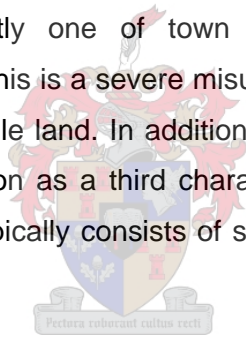
Ecological decline

The fifth environmental problem mentioned by the State of the World report of 2003, is ecological decline. It is a pervasive state that affects ecosystems globally. Primary tropical forests for example are disappearing at a rate probably exceeding 140 000 square kilometres per year. It is estimated that total global forest cover, which accounts for a quarter of the earth's land surface, have been reduced by half since the dawn of agriculture. Of the surviving forest, 30 percent is seriously fragmented or degraded. Wetlands, another sensitive

type of ecosystem, have been reduced by more than 50% over the last century (Worldwatch Institute 2003: 8). Coral reefs, the world's most diverse aquatic ecosystems, are also experiencing environmental degradation due to over-fishing, pollution, the spread of epidemic disease and rising of sea surface temperatures which is linked by many experts to climate change.

2.1.4. South Africa's segregated cities

In addition to the energy concerns and space constraints experienced by most cities in the world, South African cities also have the spatial and social legacy of the Apartheid system to deal with. In short, most South African towns still suffer from residential segregation according to race groups, where the black and coloured populations were often located on the peripheries of urban areas. This inequality has huge cost implications as people are located far from work and economic opportunities. The ineffective spatial distribution necessitates higher use of fossil-fuel transport modes which increases environmental degradation. This is augmented by the fact that the general South African residential settlement pattern is predominantly one of town centres of decreasing importance surrounded by sprawling suburbs. This is a severe misuse of available land, especially since South Africa has a shortage of arable land. In addition to fragmentation and sprawl, Dewar (in Smith 1992: 244) cites separation as a third characteristic of South African cities. The dominant urban land use pattern typically consists of separated land uses, urban elements, races and income groups.



The legacy of urban apartheid includes residential segregation, buffer zones between races, peripheralisation of the non-white population and a dislocation between residence and workplace. According to Smith (1992: 2) it is not only these problems, but also the impact of population growth on individual metropolitan areas that holds challenges for the future of urban development in South Africa.

The problems are not only of a physical nature. South Africa is characterised by diverse societies and cultures in a context of widely differing geographical circumstances. The country is characterised by extreme differences in its levels of development. As such it is a hybrid of the development patterns of the North and South and serves as an example of a country trying to bridge such gaps (Worldwatch Institute 2003: 9). It is the diversity of the country that, although adding to the complexity of its problems, also enables creative solutions and alternative approaches in developmental concerns.

The socio-political environment of the past gave rise to the creation of informal settlements. Clarke (2002: 310) estimates that these overcrowded informal settlements in South Africa have population densities ranging from 8 500 to 39 000 people per square kilometre. The influx of people from the rural areas and other areas in Africa has resulted in a phenomenal growth rate of 9% in urban areas (Clarke 2002: 310).

These settlements were not properly equipped with water, sewerage and electricity services from the outset and therefore did not provide the infrastructure for communities to develop. Also, although a large part of the society had to travel every day to the city for work, proper transport links were not established and the communities in the informal settlements and townships remained isolated.

Clarke (2002: 312) suggests that, in the post-Apartheid period, urbanisation to towns and cities accelerated because of the increase in job opportunities and due to the relaxation and subsequent scrapping of laws which regulated urban access and rights. In the consequent battle to house as many people as cost effectively as possible, the government embarked on a large-scale programme to provide shelter. Though providing necessary improvements in living conditions, the design and construction of such new housing layouts did not utilise land efficiently, nor did it create sustainable environments that enable quality living.

A more economic use of land is essential to the successful development of new housing projects in order to make housing economically and environmentally viable. Clarke (2002) suggests that the main challenge is the assimilation of so-called 'squatters' into urban life. In attempting this, socio-economic problems such as unemployment, crime and vagrancy, would also have to be addressed.

2.1.5. Current unsustainability of cities

With the growing popularity of sustainability thinking, the realisation has spread that current human development patterns cannot be continued indefinitely. Land and resources are used in a manner that is reliant upon its continued availability. Residential development, which is responsible for a large percentage of urban land use, is predominantly low-density and thus leads to ever-increasing sprawl. Williamson et al (2002: 71) subscribe to the view that urban sprawl is one of the strongest threats to the traditional concept of community. Sprawl, pertaining to spatial development and land use, is a cause of deteriorating urban communities. Coupled with this is the supremacy of automobile travel, which not only spatially and visually dominates cities but also, importantly, increases carbon emissions.

2.1.6 The local context: Cape Town

As mentioned by Goven (2003), South Africa possesses abundant mineral and potential renewable resources but insufficient arable land and water, and fragile soils and biodiversity. Thus the impact on land, water and atmosphere is a key concern.

Even though Cape Town is a relatively small metropolis with approximately 3 million inhabitants, its growth during the last century was significant: population increased more than ten-fold, the area of its built environment expanded more than thirty-fold, and its economic growth has been considerable in the last 50 years (Gasson 2002:1). These trends are continuing and during the next decade the following annual growth rates are expected: population 3,2%, water consumption 3,0%, oil 2,2%, electricity 3%, motor vehicles 3 to 5%, waste water 2,2%, solid waste 1,8%, and gaseous wastes 3,9%, as quoted in Gasson (2002:1).

In the view of Gasson (2002:1), these increases will have significant implications for resource extraction and use, waste generation, and land transformation through built footprint expansion. Cape Town's current and future ecological sustainability comes into question, together with the types of interventions that may be required to move it towards greater sustainability.

The ecological footprint concept, as explained by Wackernagel and Rees (1996: 51), *"starts from the assumption that every category of energy and material consumption and waste discharge requires the productive or absorptive capacity of a finite area of land or water. If we sum the land requirements for all categories of consumption and waste discharge by a defined population, the total area represents the Ecological Footprint of that population on the Earth whether or not this area coincides with the population's home region. In short, the Ecological Footprint measures land"*.

Studies show that high-income countries have a requirement of 5- 9 hectares of ecosystems per capita to support their lifestyle (Wackernagel and Rees 1996).

Gasson (2002) calculated the ecological footprint of the Cape Town region and from the findings, a number of conclusions regarding the future sustainability of Cape Town can be drawn (Gasson 2002:12-13). These are summarised as follows:

First, Cape Town is extremely dependent on water (a replenishable resource but one in limited supply in this drought region), on non-renewable fossil fuels, and on potentially dangerous nuclear power generation, while it makes negligible use of locally available and renewable solar and wind energy.

Second, it is dependent on extremely long-distance supply lines, particularly for its oil supplies.

Third, resource consumption is disproportionate among income groups. High-income groups, who constitute about one-third of the total population, consume the largest quantities of water, electricity, and petrol, and produce more than half of the residential solid waste. This suggests that high-income groups are making a disproportionate contribution to the ecological footprint. At the same time, large numbers of low income people lack adequate access to water, electricity, and efficient and safe public transport.

Fourth, efficiencies in water reuse, energy use, and solid waste recycling are very low.

Lastly, there is significant pollution of soil, fresh and coastal water systems, and air systems.

2.1.7. Sustainable urban settlements

In the light of existing environmental problems, urban settlements are faced with two basic choices or competing visions of the future (Beatly & Manning 1997: 1). The first is to continue the status quo by continuing with current patterns of development and consumer behaviour. This scenario is based on low-density urban development that is dependent on cars and as such encourages sprawl into rural land. Due to the patterns of consumption and waste, and large energy requirements, such towns and cities have excessive environmental footprints. In addition to the environmental damage, this model has an effect on the quality of life. With its increasingly, according to this viewpoint, anti-social living conditions due to decentralisation and loss of urban character, it encourages car-dependant, isolated household units with little communal interaction.

The second option is an alternative vision of future urban development. In this scenario, land is seen as a valuable resource along with a realisation of the limited availability of energy and other resources. This means that environmental potential is maximised by using resources thoughtfully and in keeping with certain ecological principals. As it is important to protect rural land, cities in this model would be more compact and organised not according to movement of automobiles, but in such a way that pedestrian and public transport can play a larger role. This saves valuable energy while creating towns with distinct character that provides its inhabitants with accessible social and recreational facilities. Furthermore it plays an important role in social equity, as all people have an equal ability to utilise urban services and opportunities. Beatly and Manning (1997: 2) describes this as a vision of place where both ecological and social aspects are emphasised. In effect quantity of consumption is to be replaced by quality of relationships. The authors argue that questions of ecological

sustainability are linked to the pattern of human settlement or “place”. This aspect will be further explored as it ties in with the underlying assumption of eco-villages, where specific locations serve as a base for improving sustainability. This modernist scenario of Beatly and Manning is strongly reminiscent of the 1899 “Garden City” model of Ebenezer Howard (Osborn 1946: 50 ff), the important difference being that ecological aspects of the environment have become important since then.

What needs to be considered now, given the resultant environmental and social conditions, are ways of transforming cities into more responsible ‘organisms’.

2.2 A CONCEPTUAL FRAMEWORK OF SUSTAINABILITY

Despite clear indication that alternative solutions have to be sought, the issue of sustainable development in general is still governed by uncertainty and apathy. De Graaf *et al* (1999: 3) argue that this is a result of diverse conclusions that have been drawn about natural resources. According to these authors, the predictions made in the past two to three decades concerning resource depletion and food shortages have proved to be wrong. There also exist uncertainties about the capacity of ecosystems to assimilate environmental impacts. Doubt remains about the extent to which it is possible to calculate the future environmental, social and economic situation according to which planning for sustainable development should take place.

Although the above mentioned concerns possibly limits the potential of sustainability theory to gain widespread influence, within the relevant spheres of influence it is recognised as an issue pressing enough to warrant determined and immediate action. The socio-economic prospects of a large part of the world population and the environmental hazards that are faced, necessitate continued study and implementation of development that is deemed sustainable according to the information at our disposal.

Decisions on sustainable development are taken on global, national, regional or local levels, but in each of these cases major differences emerge in its elaboration (De Graaf *et al* 1999: 7). On the global scale, the overriding issue is the contribution of lower scale development to the sustainability of the earth.

2.2.1. Defining sustainability and sustainable development

The term *sustainability* began appearing in international literature during the early 1970's and gained importance during the next decade. Although initial concerns about renewable

resource management appeared during the early 20th century, a more fully integrated approach to conservation and development only emerged in the World Conservation Strategy published by the International Union for the Conservation of Nature in 1980 (Rees in Hamm & Muttagi 1998: 101).

Traditionally the development debate in liberal democratic countries has centred on social and economic issues. Rees mentions in Hamm & Muttagi (1998: 103) that sustainability and sustainable development vary as widely in its interpretations as the ideologies of its various proponents do. Rees goes on to argue that it is the ecological realities that determine any realistic approach to sustainable development. Conventional thinking is therefore challenged by the acceptance of the limiting ecological conditions for sustainable development. This view does not lessen the importance of socio-economic progress, but places appropriate emphasis on ecological considerations. The debate, while covering a broad spectrum of political views, has thus become polarised around two main issues. Taylor, as quoted in Hamm & Muttagi (1998: 134), describes these respectively as “expansionist” and “ecological” worldviews. The need for sustainable development is agreed on by both of these groups, although widespread disagreement exists over its practical content.

‘Sustainable development’, as described by Dresner (2002: 36), is a meeting point for conservationists and developers. The Agenda 21 agreement, adopted at the Rio Summit in 1992, uses the terms ‘sustainable development’ and ‘sustainability’ interchangeably. Riordan (in Dresner 2002: 37) draws a distinction between these. According to him, ‘sustainable development’ indicates the priority of development whereas ‘sustainability’ is primarily concerned with the natural environment. The popularity of this terminology can partly be explained by its adaptability and its broad applicability. Its dual focus of environmental concern together with economic growth means that the term can be applied to widely varying contexts. Often criticised as being vague, the Brundtland definition ‘...development which meets the needs of the present without sacrificing the ability of future generations to meet their needs’ (World Commission on Environment and Development 1987) gives an indication of the wide scope of sustainability concerns. Desai (in Dresner 2002: 36) emphasises that it is not the precise definition that matters, but the values that underlie it.

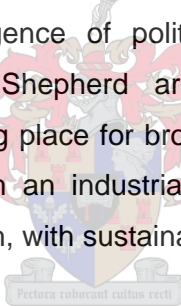
Sustainable development refers to human interventions, especially through international programmes, which takes the natural environment into account (Beatley & Manning 1997: 4). In the various definitions that exist, reference is usually made to the importance of living within the ecological carrying capacity of the planet with the view to protect future generations.

In 1993 the National Commission for the Environment, as quoted in Beatley and Manning (1997: 4) defined sustainable development as: “a strategy for improving the quality of life while preserving the environmental potential for the future, of living on interest rather than consuming natural capital.”

2.2.2 A new development paradigm

Sustainability can be seen as part of a paradigm shift that, according to Sheperd (1998: 10), is taking place in the fields of agriculture, project analysis and procedure, gender issues and local level institutional development among others. This shift represents a transition from a technical approach to development towards one that is more organic and holistic. The implicit objective of profit is being gradually replaced by a notion of sustainable improvement. Employing a participatory and inclusive approach to development that favours local resource management rather than a centralised technocratic attitude could attain this.

Conventional rural development has been part of the modernisation paradigm in which development is equated with four processes: capital investment; the application of science to production and services; the emergence of political and economic organisation; and urbanisation (Shepherd 1998: 1). Shepherd argues that such paradigms of rural development are changing and making place for broader and more inclusive approaches. It is evident that there is a move from an industrial (technical) approach to development towards an organic or holistic approach, with sustainable improvement as a general objective (1998: 10).



2.2.3. Global initiatives and policies

The Club of Rome in 1972 pointed out the limits to the natural environment and the idea of preserving natural resources. This was a sign of the growing global concern about degradation of the natural environment and the effects of, *inter alia*, global warming, the hole in the ozone layer, depleted ocean resources and slash-and-burn practices in rainforests (Claassen 2002).

The first UN Habitat summit, held in Vancouver in 1976, did not have any viable outcomes and no plan of action or commitments were agreed on. The summit highlighted certain elements of development but did not take any of these issues further. According to Dahiya and Pugh (Pugh 2000: 152), the Earth Summit in Rio in 1992 was the first opportunity for the developing world to have its say about the development of the ecological and sustainability agenda of the world. Targets were set to deal effectively with climate, biodiversity and deforestation, as well as to put together an “Earth Charter”, to which all participants of the

summit would commit. A commitment was made on sustainable development by the countries involved, but it was obvious that a host of other factors, like the history of countries, the resources at their disposal and social development, hampered the effectiveness of the outcomes and commitments made at the summit, as the natural environment was seen as an inferior priority to these other problems.

At the summit the Agenda 21 principles were accepted in order to help countries prioritise the different sustainability issues and local initiatives. With the launch of the World Trade Organisation in Marrakech, Morocco, in 1994 it was clear that global free trade was to be institutionalised while economic liberalisation would be the norm for all countries. The rapidly expanding world economy led to growing inequalities which in turn helped escalate the environmental crises all over the world.

As Dahiya and Pugh argue (Pugh 2000 :152), the Rio summit was more than an opportunity to discuss principles, issues and the idea of sustainable development; it also required negotiations, agreements and a post-conference plan of action. Hallows (in Bond 2002: 26) points out that although the Rio summit launched a number of successful institutional processes, tangible global results has yet to be produced.

The Habitat II conference in Istanbul in 1996 focused on the role of cities in the problems which create challenges for the environment (Girardet 1999: 423). The Best Practices and Local Leadership programme were the most important initiatives developed at the conference. This conference highlighted the tension that sustainability has with developmentalism and neo-liberalism. This was where the localised Agenda 21 was accepted to help deal with the sustainability of new settlements and current cities.

Girardet (1999: 423) argues that the five most important lessons that emerged from the conference were the power of good examples, the complexity of issues, the large-scale repercussions of local action and the necessity of exchanges between peer groups in different cities as well as changing the way urban institutions work.

The World Summit on Sustainable Development in Johannesburg in 2002 marked the entrance of Africa as a global player in the sustainability agenda. There was no 'grand North-South deal' but the new major role for business and capital was identified (Rossouw 2003). In adopting the Agenda 21 principles, it has been acknowledged by many of the world's governments that the resources on which modern life depends are threatened and that action is needed. This requires changes not merely on policy level, but specifically in the practical implementation of development actions.

2.3 PRINCIPLES OF SUSTAINABILITY

According to a definition by Wackernagel and Rees (in Roseland 1998: 16) the land area and the natural capital on which a city draws to sustain its population and production structure increases in a way that cannot be sustained by existing means. Trainer (2002: 62) mentions that according to footprint analyses a minimum of 4,5 hectares of land is required to provide for one person in a developed country. The principles of the ecological footprint of cities were discussed in sections 2.1 and 2.2 above, which support the claim that the living standards and levels of production and consumption characteristic of rich countries are unsustainable for environmental reasons. The prime concern is how communities can accommodate growth while at the same time reducing their ecological footprints.

One of the most important themes facing planners today is the question of sustainability and its link to spatial development. Despite the widespread and often vague use of this term sustainability, it points towards a number of pressing issues evident in the physical world today. In the context of cities, the problem of sustainability, broadly put, rests on three variables: population, natural environment and resources. These elements have to remain balanced in order to ensure the continuance of life on earth. As Roseland (1998: 5) states, global resource depletion and pollution are forcing recognition that existing patterns of resource use and development cannot be continued indefinitely. As the population grows, the supply of renewable as well as non-renewable resources comes under increasing pressure. Tickell (in Rogers 1997: vii) adds that the pressure of consumption can even render renewable resources non-renewable, or only renewable after long periods of time.

The environmental problems facing cities (and the earth as a whole) include degradation of the natural environment due to incorrect land use, air quality degradation, fresh water supply contamination, improper waste disposal, acid precipitation, the depletion of the ozone layer, human-induced climate change and the destruction of other forms of life and ecosystems. Cities, as a representation of specialised human functions, in many cases embody most of these problems. All of these potential environmental crises are linked to the delicately balanced relationship between the population, natural environment and resources.

Linked to all of these are the internal problems that cities face. With the increase in population, the social coherence of cities is threatened. Spatial organisation becomes more complex as urban sprawl continues. The reliance on low-density settlement patterns with its car-dependent lifestyle spatially fragments cities in addition to the environmental damage it causes.

It can be said that the meaning of 'sustainable cities' or 'sustainable urban development' is open to manipulation in order to meet the ends of the agencies or persons using the phrase. Woo in Walter et al (1992:3) describes "ecological cities" as an oxymoron. Los Angeles is cited as an example of this contradiction. As in so many cities, its growth has been based upon an apparent limitless supply of undeveloped land together with the unfettered use of the natural resources of water, air and energy. What needs to be considered now, given the resultant environmental and social conditions, are ways of transforming cities into more responsible 'organisms'.

There are some overarching principles important in the sustainability of cities. According to Shirley-Smith (2003: 4) social progress that recognises the needs of everyone, particularly the less advantaged, is important as is the responsible use of natural resources. The reduction of waste should be aimed for as much as possible at all stages of provision, transportation, consumption and disposal. The effective protection of the natural environment is necessary while at the same time there should be a drive towards stable levels of economic growth and employment.

The authors in Westendorff (2002: 9) mention some prerequisites for a sustainable city. Improvements in livelihood and habitat for all in the short, medium, and long run should be pursued without damaging the carrying capacity of the city's hinterland in the process. Decentralised government, democracy, and non-exploitative community participation are necessary but insufficient conditions to move cities in this direction while adverse macro-economic environments - especially unfettered international economic competition - are likely to retard movement in the right direction. Therefore a strong, just state is an essential asset for pursuing true social, economic, and environmental sustainability.

In short, a sustainable city is about progressive socio-economic development coupled with the minimisation of resource use and waste. In physical terms, footprinting and circular metabolism are indicators of a city's sustainability. According to the definitions of the World Summit on Sustainable Development and the New Partnership for Africa's Development, sustainable cities should be about meeting basic needs while accommodating economic growth (Rossouw 2003). Relational governance and innovation should be a basis for economic development, social equity and sustainable resource use and waste. People (and therefore politics) are central in this endeavour, but development and equity should be addressed within an ecological framework.

CHAPTER 3: ECO-VILLAGE THEORY

3.1. SUSTAINABILITY AND ECO-VILLAGES

The overarching concept of sustainability is often interpreted as vague and devoid of meaning in the local context. It is for this reason that its principles should be made relevant to each situation and applied to development at all levels. When referring to cities, towns or eco-villages for example, the term sustainability fundamentally implies a limit to environmental impacts and the consumption of natural resources (Beatly & Manning 1997: 27). Eco-villages, by striving for lifestyles which can be continued indefinitely, are living models of sustainability, and illustrate how action can be taken immediately. They represent an effective and practical way in which to combat the degradation of the social and ecological environment.

As discussed in section 2.1.7 possibilities for the future of human settlements basically point to two competing alternatives: the first is that the status quo is continued indefinitely, with continued dependence on non-renewable natural resources. The second is a concerted change in creating more efficient land-use and consumer patterns so as to render the available resources more sustainable. The view that the existing way of inhabiting earth cannot be sustained, have been prevalent among some people for the last few decades but it is only as information about the potential environmental crises becomes more widespread that people are considering the idea of change.

Birkeland (2002: 6) provides a summary of some basic requirements of a sustainable urban environment. Such an environment would adhere to particular guidelines regarding carrying capacity; thresholds; biodiversity; health; user-friendliness; equity and governance. These illustrate how the broader concerns of sustainability can be expressed by means of focused, pragmatic elements.

Inoguchi *et al* (1999: 4) refer to the possibility of larger scale 'eco-societies' in the urban environment. According to the authors a parallel approach is required; addressing firstly the environmental problems that exist; and secondly the underlying social, economic and political factors that form the 'root causes' of urban environmental decay. Five areas of action are cited in Inoguchi *et al* (1999: 4-6) as primary challenges in the creation of eco-societies. Waste management; pollution; transportation, water resources and energy are described as the issues that deserve the most collaborative attention from a variety of institutions in the urban framework in order to ensure sustainable cities.

The 'limits to growth' case has been well-developed over the years and it is realised that large scale global changes are necessary to counteract the process of diminishing natural resources. Trainer (in Birkeland 2002: 34) points out a number of implications for sustainable settlement design. It is emphasised that not only are physical changes required, but to accomplish this, social systems should be developed in which a satisfactory quality of life can be achieved at much lower levels of resource consumption than at present. Lifestyles would have to be simpler; a high level of economic self-sufficiency should be sought (at national as well as at local levels); and more cooperative ways of working and sharing of resources should be explored.

In this assignment eco-villages are examined as a relatively new pattern of development. Trainer (2002: 67) describes this global movement as an innovative type of development taking place at community and village level. A primary motivation for this is a spirit of self-reliance in which groups have decided to take charge of their own development. Eco-villages are based on an approach where the available technology is used to assist in environmentally-friendly practices. This indicates a significant value that eco-villages hold: they have the potential to popularise innovative approaches towards design and development of settlements. Through experimentation with various options, such initiatives can be provide useful lessons to the larger urban context. The Global Ecovillage Network (2005) estimates that more than 15 000 identified sustainable community experiments are in existence.

Rosenthal (in Kennedy 2004) underlines the significance of eco-villages as intentional communities. According to the author it is a combination of two important truths: the value of small, supportive, healthy communities; and the recovery and refinement of traditional community life as a way forward for a sustainable humanity.

3.2 THE ECO-SETTLEMENT IN HISTORY

3.2.1 Traditional settlements

The development of urban settlements from pre-history until today is an expression of the organisation of human activities. Habitable spaces are designed and adapted accordingly. A historical overview of settlement patterns reveals certain tendencies in the way that the environment is modified for human habitation and use. Initial settlements simply afforded people a more effective way of survival as far as primary needs were concerned. As human control over the environment increased and their activities expanded, settlements developed into more complex organisations. Throughout the ages it is evident that such urban efforts

can either come about through spontaneous and largely natural processes or through concerted human actions and plans. Hough (1995: 8) refers to this as two contrasting landscapes: the natural and the formalistic. Often it is a combination of these processes that provides an urban settlement with its particular morphological characteristics.

Settlements gradually expanded as their surrounding natural environment allowed and as technology developed. The defining characteristics of these first communities were that they lived relatively 'close to nature', in harmony with their natural environment, and had decentralised governments. Examples of such settlements are Çatal Hüyük in Turkey, Jericho, the Minoan and Mycenaean cities on Crete, the Pueblos of the American southwest, and even today, some isolated tribes and traditional villages. Advocates of the eco-village idea set much store by the sustainable living of ancient villages. Views on these influences are expressed by Cole (1991) and Register (2002).

According to Register (2002: 82) such settlements had the potential to allow materially productive and socially satisfying communities in a mutually beneficial relationship with nature. These early villages share a number of similarities with what today is described as eco-villages. Through limited agricultural efforts, human needs were met without unnecessary pressure on the natural environment. The combining of human skills aided intellectual improvement and consequent development. These types of settlements saw buildings primarily as a part of a whole community which was embedded in the natural environment. There were no formal distinctions between city planning and architecture. The creation of social spaces, streetscapes and public buildings were of special importance in such settlements.

These primitive settlements had its limitations. Notwithstanding the interesting aspects of primitive village life, the transferability of those ancient systems to modern living is questionable. In the case of traditional settlements, the human population did not yet exceed the carrying capacity of the natural world nor did early human settlements have to face the reality of environmental problems on a global scale. The possible reason for a closer link with nature in ancient times is the absence of choice. Sufficient technology enabling the urban functions regarded as vital today did not yet exist. Furthermore high infant mortality, low life expectancy and the absence of human rights principles strongly influenced their way of living. Concepts such as gender equality did not exist then. The assumption that centralised government (and globalisation) counter sustainable living, is also questionable. Yet, studying primitive society (ancient and recent) is worthwhile, if only to see whether there are lessons for sustainable living that can be learnt. Idealising primitive societies without recognising the hardships that their citizens had to endure, the pervasive inequality and their oppressive

customs, is, however, very subjective. It is made clear by proponents of eco-villages (EcoLogical Solutions 2003: 4) that while the study of traditional villages can be informative, eco-villages are a distinctly 'post-industrial' and even 'post-agricultural' phenomenon. It is not seen as a return to a previous way of life, but a direct response to new ecological constraints, new techniques and technologies available and new levels of awareness.

3.2.2. Emergence of eco-villages

Over time, there have been repeated efforts to provide a tangible form to the concept of an ideal society or community. In a variety of social experiments, attempts were made to organise the lives of people according to certain ideas. Geffer (2005: 6) refers to the fact that between 1810 and 1850 an estimated 600 utopian communities were established across the American continent, motivated by religious as well as secular views. These were later followed up by a new wave of 'alternative communities' as part of social upheaval during the 1960's. More recently, new ideas regarding urban planning have led to more practical experimentation with an utopian vision of design.

Eco-villages or sustainable communities are now being created intentionally as part of a global movement to give people the opportunity to once more live in communities that ensure the well-being of all life-forms into the indefinite future.

It is difficult to chart the precise emergence of eco-villages as many of them were founded before the term itself came into existence. During the 1960's several initiatives for projects with spiritual and ecological foundations happened around the world. These, according to the Global Ecovillage Network (2005), include Findhorn in Scotland, Auroville in India, The Farm in Tennessee, USA, Sarvodaya in Sri Lanka, and the NAAM movement in Bukino Fasso. Such environmentally-aware communities developed in isolation and without the guidance of an organised movement. However, it had in common a desire to "live in harmony with nature in a sustainable and spiritually satisfying way in a technologically-advanced society" (Global Ecovillage Network 2005).

Kennedy (2004) mentions that, while the term 'eco-village' is relatively new, perhaps from the mid-1980s, communities described by that term have been around for much longer. Examples of Steinerian communities, like Solheimer in Iceland and Jarna in Sweden that emerged in the late 1920s and early 1930s, are cited by this author. The concept of communal living continued to evolve through the Danish co-housing movement.

The Gaia Trust, established by Ross and Hildur Jackson, became instrumental in the development of the eco-village movement. The precursor to the Gaia Trust was the Nordic

Alternative Campaign that, from 1982 to 1989, linked 100 Nordic grass roots movements with the scientific community in an effort to solve global social and environmental problems. From this campaign it emerged that a suitable knowledge base existed for the creation of sustainable communities. The Gaia Trust continued the interactive relationship between sustainable, spiritually-based development and technological and economic progress.

In 1991 the Gaia Trust commissioned a survey of the best examples of eco-villages globally. The study, performed by Robert and Diane Gilman, found that despite many variations of sustainable communities, the full-scale ideal eco-village did not yet exist. However, the projects that were surveyed gave definite insight into the requirements of the envisioned culture and lifestyle of eco-villages.

Following the Gilmans' report, representatives from some of the communities and other people with a global social interest, met in Denmark in 1991 to discuss a strategy for developing and spreading the eco-village concept. According to Jackson (Global Ecovillage Network 2005), this provided the opportunity to establish links between people who found that they had common ground on which they could work together. Denmark, because of its experience with other alternative housing arrangements, emerged as a leader in the development of eco-villages. In 1993 the Gaia Trust brought together a number of established and emerging eco-villages as the Danish Association of Sustainable Communities.

The first Eco-Villages and Sustainable Communities conference was held in Scotland in 1994. By this stage, eco-villages have been formed on all five continents. The global eco-village strategy was finalised at a second meeting in Denmark in 1994. The Global Ecovillage Network was informally initiated with a secretariat in Denmark funded by the Gaia Trust. Formed as a response to the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro and the subsequent Agenda 21 declaration, the Global Ecovillage Network's goal is to "create and promote viable human settlements that allow people to live healthy, fulfilled lives in harmony with the environment, as well as providing work opportunities and financial security" (Global Ecovillage Network 2005). Early members included the Findhorn Community, Scotland; The Farm, Tennessee, USA; Lebensgarten, Germany; Crystal Waters, Australia; and other eco-villages in countries as far afield as Russia, India and Hungary. During a conference in Scotland during 1995 it was decided to establish three autonomous regional networks to cover the globe geographically, with administrative centres at The Farm (USA), Lebensgarten, (Germany) and Crystal Waters (Australia). This co-ordinated response, in the view of Craig (2001: 1) is a local-level parallel process to global sustainability initiatives.

3.3. SUSTAINABLE COMMUNITIES

Flora *et al* (2004: 7) describe the concept of community in several different ways. People typically act through communities, not merely geographically, but also socially. For that reason it is difficult to define the precise nature of a community. In one use of the term, it is a place or location in which members of a group interact with one another. A second use of the term alludes to the shared social system or organisation that exists.

According to Gilman (1991: 2) the more general term "sustainable community" includes eco-villages, but it also includes clusters and networks of eco-villages, and non-geographically based communities (such as businesses) that are nevertheless human-scaled in their components, diverse, and harmoniously integrated into the natural world. In this sense, an eco-village is a distinct place, either as a rural village or as an urban or suburban neighbourhood. A city cannot be an eco-village, but a city made up of eco-villages would be termed a sustainable community.

As a response to the environmental problems mentioned in Chapter 2, it is necessary to start looking at other models and types of urban settlements. One such approach can be termed 'sustainable communities'. This does not necessarily describe a specific type of city, neighbourhood or region. As Roseland (1998: 14) points out, activities that the environment can maintain and that the citizens want and can afford may vary from one community to another. A sustainable community therefore is one that adjusts itself continually to meet the social and economic needs of its residents while preserving the environment's ability to support it.

Roseland (1998: 14) provides the following definition of a sustainable community: *"A sustainable community is a community that uses its resources to meet current needs while ensuring that adequate resources are available for future generations. A sustainable community seeks a better quality of life for all its residents while maintaining nature's ability to function over time by minimizing waste, preventing pollution, promoting efficiency and developing local resources to revitalize the local economy. Decision-making in a sustainable community stems from a rich civic life and shared information among community members. A sustainable community resembles a living system in which human, natural and economic elements are interdependent and draw strength from each other."*

In the study *Defining a Sustainable Community*, Klein (2003) offers four characteristics of a sustainable community. These are:

i) Economic security

A more stable community should provide for a variety of business opportunities, industries and institutions which are environmentally sound and financially viable. These should provide training, education and other forms of assistance to ensure adjustment to future needs. Jobs are to be available to community members and they should have a voice in decisions which affects them. In a more sustainable community residents' money remain in the community.

ii) Ecological integrity

A more sustainable community stays in harmony with nature by utilising the natural ability of environmental resources for human needs without undermining their ability to function over time. Such a community also respects natural systems by reducing and converting waste into non-harmful and beneficial products.

iii) Quality of life

A sustainable community recognises and supports people's sense of well-being, which includes a sense of belonging, a sense of place, a sense of self-worth, a sense of safety, and a sense of connection with nature. Goods and services are provided which meets people's needs, but with the ecological integrity of natural systems in mind.

iv) Empowerment and Responsibility

In a sustainable community people are empowered to take responsibility based on a shared vision, equal opportunity, ability to access expertise and knowledge for their own needs and a capacity to affect the outcome of decisions which affect them.

To summarise, a sustainable society is one that can persist over generations as its physical and social systems of support remain intact.

Roseland (1998: 2) cites various motivations for the transformation that can be detected in communities around the world. Parallel to the bureaucratic and governmental concerns with sustainability, citizens themselves are displaying a desire to improve community life, protect the environment and to participate in decisions relating to poverty and other social conditions. This informal sustainable communities 'movement' is not only about sustaining but especially about improving the quality of people's lives.

3.3.1 Checklist for sustainable communities

The Global Ecovillage Network is developing the concept of sustainability auditing in the context of villages and communities. Their Community Sustainability Assessment (CSA) provides a tool for comparing the current status of communities with the ideal ecological, social and spiritual sustainability goals. The process of assessment can also be seen as a learning instrument that points out actions that communities can take to become more sustainable. A summary of the main issues of the Community Sustainability Assessment is provided in *Addendum A*.

The checklist takes the ecological, social and spiritual aspects of a community into consideration to provide an indication of its overall sustainability. According to the authors (Global Ecovillage Network 2005) a community in which the ecological aspects are balanced, displays a number of characteristics. In such communities people profess a connection to the place in which they live. Natural life, its systems and processes are respected while the wildlife and botanical habitat is preserved. The integrity of the environment is regenerated rather than diminished. An ecologically-balanced community's food comes primarily from local sources and is preferably organic. In the built environment, structures are designed to suit and complement the natural environment, using natural, bioregional and ecologically sound materials and methods of construction. Conservation is practised in transportation systems and methods. Consumption and generation of waste is minimised. A clean, renewable water supply is available and is protected and conserved while human waste and waste water is disposed of to the benefit of the environment and community. In ideal ecological situations, renewable, non-toxic energy sources are used to heat and power the community and innovative technologies are appropriately utilised.

According to the website (Global Ecovillage Network 2005), a community is regarded as socially-balanced when the following is present: a sense of social stability and dynamism in community life and a foundation of safety and trust that enables individuals to freely express themselves to the benefit of all. Spaces and systems are available that support and maximise communication, relationships and productivity. Adequate opportunities and technologies enable communication within the community and further afield. Resources and skills are shared freely within the community and offered outside of the community to serve the greater good. Diversity is encouraged as is acceptance, inclusiveness and transparency. Learning and creativity are valued and nurtured by having opportunities for teaching and learning available to all age groups through a variety of educational forms. Physical, mental, emotional and spiritual health is promoted by the availability and affordability of the necessary practices. Lastly, a community is deemed socially sustainable when its flow of resources is balanced to meet the community's needs and wishes.

A spiritually-balanced community, it is claimed, has a cultural vitality which is sustained through artistic and other cultural activities and celebrations (Global Ecovillage Network 2005). Creativity and the arts are encouraged and supported. There is respect and support for spirituality manifesting in many ways. A sense of unity in the community is achieved sharing a common vision and agreements that express commitments; it may be shared cultural beliefs, values and practices that define and express the uniqueness of each community. Socially sustainable communities should ideally have a capacity for flexibility and successful responsiveness to difficulties that arise.

3.3.2 Intentional communities

'Intentional community' is an inclusive term for eco-villages, co-housing, residential land trusts, communes, student co-ops, urban housing co-operatives and similar projects that appears in a range of literature. It does not necessarily allude to a sustainable settlement, but it is often the case that a sustainable settlement or community originates intentionally.

3.3.3 Co-housing

Co-housing was pioneered in Denmark in the early seventies, mainly as a result of dual income professionals searching for better day-care and a safer neighbourhood (EcoLogical Solutions 2002: 94). It has since evolved into an intergenerational mix of various family types and is described by Roelofs (in Satterthwaite 2001: 240) as an increasingly popular semi-communal model.

Co-housing developments vary in size, location, type of ownership, design, and priorities. Usually limited to a size of between 18 and 25 units co-housing design is based on a concept of balancing community and privacy in a village-like manner. It has some features in common with eco-villages, for example the active involvement of the community in the design and development of their living environment. Some characteristics of co-housing as mentioned in Co-housing Resources (2005) are:

Participatory process

Future residents participate in the planning and design of their community and as a group are responsible for most of the final design decisions.

Intentional neighbourhood design

The physical design places strong emphasis on a sense of community. Pedestrian walkways or village greens are dominant, while cars are generally relegated to the edge of the project.

Private homes and common facilities

Significant common facilities are generally included in the design of the community, but all residents also own their own private homes. Common areas are designed for daily use, to supplement private living areas and promote a communal spirit.

Resident management

Residents in co-housing usually manage their own community and make decisions of common concern at regular community meetings.

Non-hierarchical structure and decision-making

Decisions regarding the community are made together and courses of action are democratically decided on.

It is mentioned that the co-housing model does not involve any system of shared income. Employment and business endeavours are privately organised. It is also emphasised that common ideologies are not a prerequisite for such a type of communal living.

Since the completion of the first project in Denmark in 1972, nearly 200 others have been completed. Similar projects have also been undertaken in North America and it is estimated that more than 150 groups are currently in the process of establishing co-housing sites (EcoLogical Solutions 2002: 94).

Although both eco-villages and co-housing can be classed as sustainable intentional communities, confusion sometimes exists on the differences between these types of developments. Mariner (in Co-housing Resources 2005) states that some co-housing neighbourhoods can be described as “aspiring” eco-villages. A typical co-housing development does not possess the wider environment associated with eco-villages, but does in some cases have the potential for further development that can transform it into a settlement that functions like an eco-village. Co-housing can for example be a component in an eco-village that also has businesses, agriculture and other features.

3.4. DEFINING ECO-VILLAGES

3.4.1. Definition

Eco-villages are described by the Global Ecovillage Movement (2005) as urban or rural communities of people, who strive to integrate a supportive social environment with a low-impact way of life. To achieve this, they integrate various aspects of ecological design, permaculture, ecological building, green production, alternative energy and community building practices.

Eco-villages are created as a response to the environmental and social problems of our times. It is an attempt to live sustainably in the face of the limits to growth that the planet is experiencing and to renew the quality of lives with a reconnection to nature. Kennedy (2004) suggests that the motivation for eco-villages is the need to reverse the gradual disintegration of supportive social and cultural structures and the upsurge of destructive environmental practices on our planet.

As is to be expected, the field of reference for eco-villages corresponds largely to that of sustainability itself. Eco-villages are built upon a combination of social and cultural, ecological and economical dimensions. The ecological dimension is addressed by allowing the inhabitants of a village a personal connection to nature and by emphasising respect towards it. The nature of human activities is modified to an extent that sufficiently limits damage to the physical context, but still allows inhabitants to benefit. Ecological activities, as mentioned by the Global Ecovillage Network (2005) include the growing of food, organic production, the creation of buildings using environmentally-friendly materials and techniques, the use of renewable energy systems where possible, the protection of bio-diversity, the fostering of ecological business principles, the preservation of clean soil, water and air through correct energy and waste management, the protection of nature and wilderness areas as well as an assessment of all products used in the eco-village from a social, spiritual and ecological view.

The social aspect is equally important. Eco-villages are primarily communities in which inhabitants are to be supported in a network of like-minded people. People are to be empowered by having an equal opportunity in making decisions that affect their own lives and that of the community. The Global Ecovillage Movement (2005) explains what this means in terms of eco-villages. According to them, it entails recognising and relating to others; sharing common resources and providing mutual aid; emphasising holistic and preventive health practices; providing meaningful work and sustenance to all members;

integrating marginal groups; promoting ongoing education; encouraging unity through respect for differences; and fostering cultural expression.

Despite the emphasis placed on the social dimension by proponents of eco-villages, it can be a difficult element to manage. Crow and Allan (1994: 133) refer to the complexities in the creation of community life. They point out that traditional communities have evolved through a gradual process. Intentional settlements might therefore encounter novel problems in their quest for a like-minded society. In their view (1994: 134) the endeavour to create communities is hampered by the perception of community life as 'natural' and therefore antithetical to planned intervention.

Spirituality is respected as a personal choice and is part of the eco-village lifestyle, but usually no emphasis is placed on particular spiritual practices. In accordance with the respect that is held for diversity, cultural, artistic and spiritual expression is accepted as part of individual lifestyles within the community. This can take the form of shared artistic expression; cultural activities, rituals and celebrations; a sense of community and mutual support; shared vision and agreements that express commitments, cultural heritage and the uniqueness of each community.

Eco-villages can be summarised as 'intentional communities striving to create cooperative lifestyles in harmony with their local environments' (Living Routes Consortium 2005). Eco-villages world-wide are developing and refining social and ecological tools such as consensus decision making, inter-generational care, alternative economic models, whole systems design, permaculture practices, renewable energy systems, and alternative modes of education that offer positive visions and real-life solutions for humanity and the planet. These communities are part of an emerging global culture of sustainability.

Eco-villages can be defined in a number of ways. The Global Ecovillage Network (2005) describes eco-villages as urban or rural communities of people who strive to integrate a supportive social environment with a low-impact way of life. This lifestyle might incorporate various aspects of ecological design, permaculture, ecological building, green production, alternative energy and community building practices.

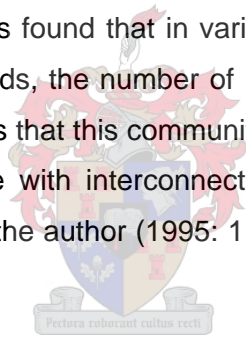
Robert Gilman of the Context Institute (1991: 10) defines an eco-village as a human scale, full-featured settlement that harmlessly integrates human activities into the natural world, supports healthy human development and can be successfully continued into the indefinite future. These characteristics can be influenced to varying degrees by the cultural and socio-economic context within which the settlement exists.

According to the Gilman definition, the characteristics of eco-villages can be summarised as follows:

Human scale

This description implies that the size of an eco-village should be restricted to that of a community where all inhabitants can interact on a personal level. It should be on a scale where people know each other and where every member is able to take part in communal decisions and activities. According to Gilman, evidence from modern industrial societies indicates an upper limit of approximately 500 people for such a group. In stable environments, this number can be higher without affecting the character of the community, but often a smaller-sized settlement would be more conducive to a close-knit, interactive environment. In Danish co-housing projects for example, it has been found that a cohesive community is best achieved at an upper limit of 30 dwellings or 75 people. This does not rule out higher numbers of inhabitants.

Papanek (1995: 110) refers to a Yale University study in which the ideal community size has been examined. The authors found that in various well-functioning social groupings in a variety of settings and periods, the number of individuals generally ranges between 400 and 600. Papanek concludes that this community size of about 500 people enables a 'benign, neighbourly' way of life with interconnections and cultural opportunities. This knowledge should, according to the author (1995: 112) be used in all levels of settlement planning.



Full-featured settlement

People living in an eco-village should be afforded all the opportunities normally associated with living conditions. Thus provision should not only be made for the appropriate residential functions, but also for economic, social, leisure and commercial activities. The nature of these activities does not have to conform to standards associated with urban lifestyles, but can be in keeping with the ecological spirit of the settlement. In the current human settlement patterns of industrialised society, urban functions are separated and spatially spread out. In contrast to this, eco-villages provide the opportunity to organise activities in a balanced manner on a human-oriented scale. Such an integration of functions allows an eco-village to become a "comprehensible microcosm" of society.

Despite the ideal of a comprehensive cluster of activities, eco-villages do not have to be completely self-sufficient and disconnected from the surrounding context. It is especially in the link with its surroundings that positive opportunities are created. Certain specialised

services are dependant on larger numbers of people and such functions logically cannot be provided for in an eco-village. It is thus important that sufficient links exist between an eco-village and its context. In essence an eco-village should be about diversity, regarding both its inhabitants, and the activities that it supports.

Harmless integration of human activities into the natural world

This principle of eco-villages brings into focus the importance of the natural environment. In accordance with sustainability principles, equality should exist between human beings and other forms of life. This in effect limits the domination of humans over nature. Many of the characteristics of eco-villages are derived from a sensitive integration of humans into a natural system. One of the most important elements in this regard is the cyclical use of energy and materials. The linear approach of industrial society has created a culture where consumption is not linked to any form of responsibility of its consequences. This inefficiency in the use of scarce natural resources along with the growing accumulation of waste cannot be continued indefinitely. Eco-villages, as initiatives conscious of these problems, therefore concentrate on the use of renewable resources, the composting of organic wastes, the recycling of as much inorganic materials as possible and the avoidance of toxic and harmful substances.

Support of healthy human development

Gilman (1991: 11) explains “healthy human development” as involving a balanced and integrated development of all aspects of human life, namely the physical, emotional, mental and spiritual facets. It is important that such development should be aimed at the community as a whole. As such the principle influences the economic, governance and social issues of the community.

Successful continuance into the indefinite future

This principle indicates the relevance of accepted sustainability thinking to eco-villages. Without the limitations enforced by sustainable practices, it would be entirely possible to create model eco-villages, but these would still rely on ways of living that cannot be continued indefinitely. Gilman (1991: 11) states that the sustainability principle requires a commitment towards fairness and non-exploitation. This translates into respect for other parts of the world, human and non-human and all future life. A decreased dependence on capital imported from outside the eco-village and greater self-sufficiency in terms of food production is one way in which eco-villages can fulfil the criteria.

3.4.2. Characteristics of eco-villages

Trainer (2002: 69) mentions a number of core principles of eco-villages and similar settlements. The concept of local action is seen as an important component in all such initiatives. In this regard it can be argued that there is a lesser reliance on external market forces as community decision-making bodies gain in importance. Often there is an attempt to build local economies distinct from national or international economic spheres. There is a direct benefit as local resources are applied to local needs. Local people have more control in decisions affecting them and there is a strong sense of participation and co-operation within the community. Large capital layouts are not always essential as use are made of low and intermediate technologies. It can be said that these types of settlements aim to establish satisfactory and sufficient living conditions without resorting to western consumerism.

Such initiatives, be they termed eco-villages or sustainable communities, vary in their development visions. According to Trainer (2002: 69) some merely involve a struggle for self-sufficiency, whereas others are consciously working towards radical transformation from existing society. What these practices have in common is an exploration and demonstration of the viability of alternative ways of development in search of sustainability.

It can be argued (for example by Van der Ryn and Cowan 1996: 107) that wireless technology and telecommunication systems can bring about a re-evaluation of and a return to 'quality community life'. Despite the shifting conditions of contemporary family life, such advances may lead to a renewed appreciation of the physical environment around the home, as learning and working from home becomes a more widespread reality. Such a combination of environmental quality and modern technology can be seen in for example the Milton Eco-Tech Village (BGD Consulting 2002). This particular development is described as a fusion of two concepts 'at the leading edge of community design': the eco-village and the so-called 'tele-village'. It is to be a combination of an ecologically responsible, low impact development with 'green' buildings together with high-technology, live-work communities. The sustainable buildings are to provide flexible and advanced spaces for residential, commercial and institutional functions. In its effort to provide a 'mixed use, compact development that reflects the principles of sustainable, healthy communities' (2002: 5), many of the issues discussed in this assignment have been examined.

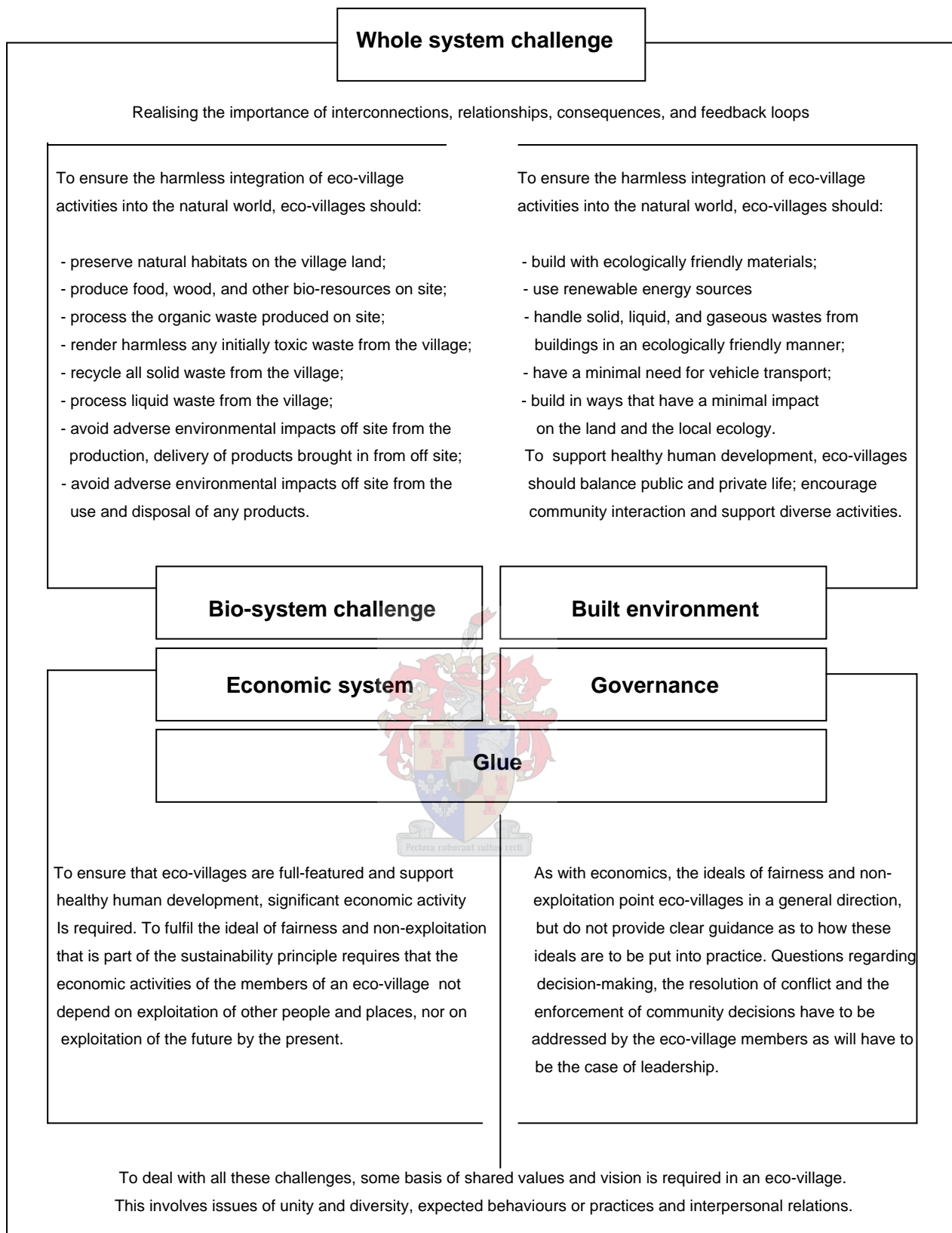


Figure 2:

Diagram explaining the main challenges of eco-villages

(Adapted from EcoLogical Solutions 2002: 5 and Gilman 1991)

3.4.3. Creating an eco-village

Kennedy (2004) mentions two important aspects in the creation of a successful eco-village. The first is the realisation that a sustainable process is as important as a sustainable village and that all phases of the project therefore deserves equal emphasis. This includes initial research and development, creation and implementation, to the ongoing maintenance of the final eco-village itself. Secondly, those involved have to determine how decisions will be made and how things are to be done. This is an important aspect as the typical high densities of eco-villages require highly-developed social skills and careful community design.

Eco-villages face many challenges in establishing lifestyles within the framework of sustainability. These challenges, as discussed by Gilman (1991) make up an important part of theoretical thinking around eco-village development and are summarised in *Figure 2*.

3.5. CRITICISM OF THE ECOVILLAGE CONCEPT

The theory surrounding eco-villages can easily deteriorate into idealised visions. In some cases eco-villages are suggested as perfect solutions in direct contrast to the insoluble problems that any other path of development would offer. In the *Ecovillage Vision of 2000* (as quoted in Kennedy 2004), eco-villages are described as a way of manifesting “a world in which rainforests expand, oceans and lakes teem with fish and marine mammals, new coral reefs are born, the variety of species of life expand and the human prospect grows ever more secure”. Without denying the positive implications of eco-villages, such a vision, if at all possible, is still a far way off.

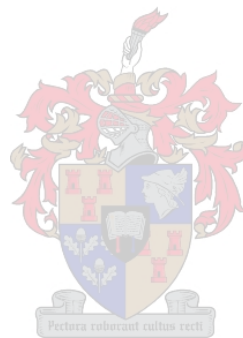
Citing reasons for the development of eco-villages, Kennedy (2004) refers to people’s wish to satisfy their basic needs in sustainable, pleasant and healing ways. According to the author, eco-villages are designed to satisfy these needs. It provides the opportunity for secure communities with a sense of identity and self-esteem. It is implied that eco-villages are in all cases ideal settlements where people can “reduce the stress in their lives through living creatively in a beautiful natural setting” as well as having more meaningful social interaction.

Cummings (1999: 1) refers to critical comments that Peter Harper made about his own community (the Centre for Alternative Technology). According to Harper, lessons pertaining to eco-villages can be learned from that community’s experience. Eco-villages need to plan for the long run, not necessarily for ‘imminent apocalypse’. He adds that eco-villages should engage with, not retreat from modern society and that they should move towards sustainability instead of ‘neo-primitivism’. The author also feels that urban design should be

emphasised more than the rural aspects of eco-villages. In short Harper, while acknowledging the positive aspects of eco-villages, argues that care should be taken not to get trapped in a dogma of “naïve, utopian communalism” where eco-villages are concerned.

This might well be the case to some extent, but according to this particular view, little room is left for cultural and societal variation. Mention is not made of the widely different socio-economic and geographical contexts in which eco-villages could possibly exist, thereby implying that it is more often than not a middle-class, slightly elitist concern. However, eco-villages hopefully have the potential to be diverse places that cater for a variety of people and their needs.

The main criticism that can be levelled at eco-villages, is that it is a small-scale initiative that does not necessarily have the capacity to make the desired impact. Questions remain about how all the energy put in to such developments can be useful to society at large.



CHAPTER 4: ELEMENTS OF ECOVILLAGES

4.1 SUSTAINABLE DESIGN

Sustainable design, green building, ecological design and organic architecture involve more or less similar concepts of ecologically appropriate design and building practices. Such design approaches attempt to address the negative impact on nature by using suitable materials in environmentally- friendly construction practices.

Goven, in a presentation on Ecological Design (2003), points out that ecological design primarily relates to the reduction of the flow of matter and energy from one geo-chemical reservoir to another. In their activities humans are responsible for the redistribution of the chemicals on earth in an unsustainable manner. Through economic consumption, material flow follows the following pattern: resources are mined, treated, transported, made into goods and distributed after which it is emitted as waste or refuse (Hawken *et al* 1999: 62). Ecological design improves the flow of materials and energy by aiming to provide the same material benefits but with reduced energy, cost, transportation, pollution and waste.

Ecological design aims to address the conflict that seems to exist between economic development and ecological principles. It requires novel approaches and innovation in finding suitable solutions. Problems have to be rethought and thus require more time than standard, traditional approaches. However, it is felt that the goal of long-term environmental quality justifies this process.

4.1.1. Definition and principles

Sustainable design is defined by Edwards (1999: 124) as a component of sustainable development that entails the design of buildings which are *resourceful* in the use of energy, *robust* in use, *appropriate* in the choice of materials and services and *durable*. These characteristics should enable sustainably designed buildings to be used or adapted profitably by future generations. Sustainable design necessitates a critical approach regarding environmental impacts at all levels of development. Thus it is not only at a global or national scale that sustainable practices have to be employed, but also at the scale of individual buildings and landscaping. The challenge of linking design solutions across different levels requires an awareness of site-specific detail that extends to knowledge of global environmental effects. According to Goven (2003) the same principles apply to all levels, but different strategic choices would have to be made to accommodate the varying political, policy and land tenure constraints that come into play in the ecological design process.

4.1.2 The necessity of ecological design

Van der Ryn and Cowan (Ecological Design 1996: 9) claims that in many ways the environmental crisis is a design crisis. It is through ecological design that sustainability can best be illustrated on a practical level. The interface between building processes, architecture, agriculture, engineering and technology and the ecosystems within which these are based, provides opportunities for a re-examination of human environmental intervention. It is at this level that decisions can be made about specific ecosystems. Projects can be designed and implemented to enhance rather than to cause damage. This also applies to the design of products - devising methods of creating products that do not deplete limited resources, nor cause pollution through their use and disposal.

The view is held by some (Birkeland 2002: 16) that ecological design can reduce many of the side-effects and even causes of inequitable wealth transfers. This is possible since more social and environmental value is gained from less resources and energy. However, despite the potential of design to address inequality, it also remains a mechanism that enhances social divisions through symbolism and conspicuous consumption.

To address the global problems outlined in Chapter 1, interconnected solutions on a multi-national scale are necessary. However, the nature of ecological and environmental problems also demands attention to detail and context. Often solutions are dependent upon respect for the particular qualities of a situation. Van der Ryn and Cowan (1996: 7) state that the only long-term approach to building a sustainable world is based on a redesigning of the details of products, buildings and landscape. This view is based on the characteristics of ecological sustainability supplied by David W. Orr (1996: 7). The first point that is made is that human capacity only allows a certain scale of comprehension and management. Second, a sustainable world can only be constructed from the bottom up by specific actions. Self-reliant and self-organised communities are important in this regard. Third, culture and place and the accompanying traditional knowledge are powerful tools in building a sustainable world. Fourth, nature is cited as the best model for the design problems and should be seen as more than a bank of resources. These characteristics should inform redesign - sustainable design should attend to scale, community self-reliance, traditional knowledge, and nature itself.

4.1.3 Green building and ecological architecture

Architecture can be described as one of the most visible chroniclers of environmental progress (Vale 1991: 31). During the twentieth century, architecture contributed to

environmental problems due to wastefulness associated with construction technology and the long-term energy requirements of buildings. Not only has there been a high demand on natural resources, but little respect has been shown for the environment in terms of land use, natural ecosystems and pollution. Basic resources have become part of a throughput system that does not provide meaningful returns (Pearson 1989: 25). Buildings as we have become accustomed to them, have a linear throughput of resources. Fresh air, electricity, water and materials are seen as being available indefinitely. It is used and then simply discarded as polluted air, wasted energy, sewage and waste products. In contrast to this, the aim of ecological building is to enable circular metabolisms for buildings. In this case air, energy, water and materials are treated as resources that are to be re-used and recycled in a variety of ways.

According to Hawken *et al* (1999: 86) such buildings are relatively inexpensive to build, operate and convert to other uses. The integrative nature of the design process can be more costly as are some technological components, for example photovoltaic cells. These costs can however be offset by long-term savings, mainly through energy-efficiency. By means of passive heating and cooling techniques, efficient buildings can save 70 to 90 percent of traditional energy use (Hawken *et al* 1999: 87). Infrastructure costs can also be significantly lower in ecologically designed buildings and settlements.

Hawken (1999: 85) describes green building or development as a fusion of resource efficiency, environmental sensitivity, attention to human well-being and financial success. Green building depends on an integration of design to a greater extent than traditional planning and construction. Traditional professional boundaries are crossed in an effort to provide the most efficient solutions to problems. According to Edwards (1999: xv) sustainable development can only be achieved through a co-operative effort by architects, engineers, designers, town planners and the manufacturers of building products. Roaf *et al* (2001) feel that it is the responsibility of the current generation to adapt buildings to ensure future sustainability. According to these authors it is not an impossible task as multi-disciplinary skills and knowledge are available, together with new materials and technologies.

The importance of built structures and its resultant living patterns cannot be underestimated as the construction and operation of buildings account for one-third of global energy consumption and use 40% of the materials that enters the world economy (Beatly & Manning 1997: 124). Despite these alarming figures, architecture has the ability to advance ecocentrism through a dual responsibility: by solving environmental problems as well as visually celebrating the results of good design (Vale 1991: 31). In the view of Wines (2000:

233), architecture still has one of the most important conservation and communication roles to play in any new ecologically responsible vision of the future.

Woolley *et al* (2000) provides a number of principles of Green Building:

Reducing energy in use

This can be achieved by various practical means. The maximised use of insulation which has low embodied energy, combined with efficient ventilation, to a large extent enables passive climate control which reduces energy consumption. Passive and solar energy together with natural ventilation systems, provide the most environmentally- friendly solution to energy requirements in buildings. Additional energy reductions can be made by using low energy lighting and electrical appliances and efficient low pollution heating.

Minimising external pollution and environmental damage

The natural surroundings of buildings should be respected and the destruction of natural habitats avoided. The re-use and recycling of water and waste on site minimises external pollution.

Reducing embodied energy and resource depletion

The use of building materials with the lowest possible embodied energy is an important aspect in Green design. It is preferable to use local, rather than imported materials. Materials from sustainable managed sources are preferable to those from non-renewable sources. The re-use of materials or buildings where possible is an efficient way preventing resource and energy depletion.

Minimising internal pollution and damage to health

Green buildings should also provide safe and healthy internal environments. This can be achieved by using non-toxic and low emission materials where possible. The impact of electromagnetic fields can be reduced, as can the effect of duct and allergens.

Kim and Rigdon (1998: 8) propose three overarching principles in sustainable design. These principles and their corresponding strategies are shown diagrammatically in *Figure 3*.

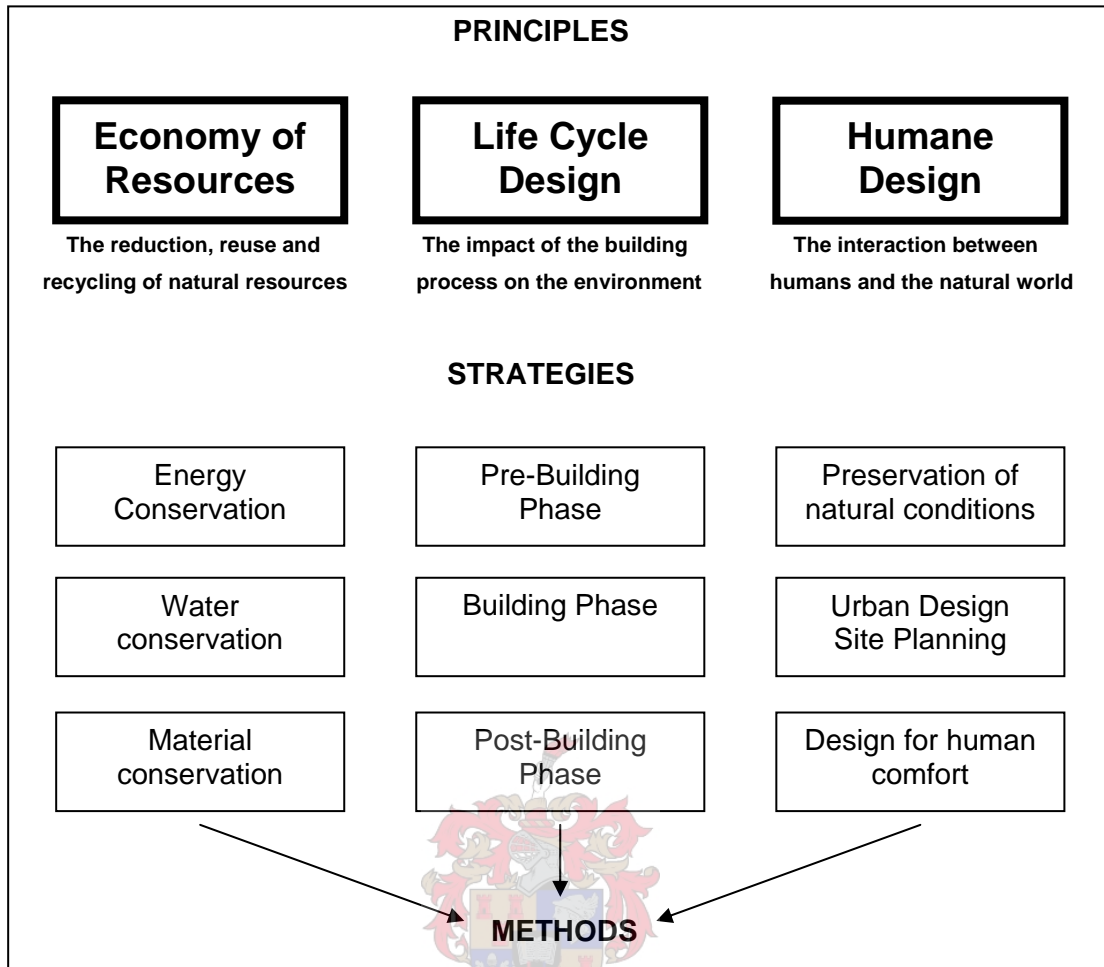


Figure 3:

The principles and strategies of ecological design

(Kim and Rigdon 1998: 8)

4.2 INFRASTRUCTURE AND LAYOUT PRINCIPLES

Gilman (1991) explains that the building of a successful eco-village requires a balance of activities among three major phases - research and design; creation and implementation; and maintenance - for each of the challenge areas (see *Figure 2*).

Many eco-villages are in rural locations, although it is felt by some that taking land away from nature for human habitation is a breach of principle. As a result, projects are increasingly focussed on the urban restoration of “brownfield” sites into eco-villages (Kennedy 2004). Urban eco-villages have more access to recycled building materials and unused warehouses, old factories and similar buildings in economically depressed neighbourhoods. Effective demonstration models can often be created faster than in the case of completely

new developments. While urban eco-villages mostly focus on community renovation and rejuvenation, rural eco-villages have a more ecologically-orientated approach. Less restricted by building codes and regulations, they often can build with alternative materials, and design and employ innovative systems for water treatment and power generation.

While urban or suburban eco-village projects often are built and finished all at once, rural eco-villages tend to build incrementally. The main reason for using greenfield land for eco-villages, according to Jackson and Svensson (2002: 132), is the relative simplicity with which convincing eco-village models can be established. Such models would illustrate how all the elements of sustainability fit together. It can then be replicated in full or in parts in local neighbourhoods.

Whether rural or urban, numerous factors must be considered when deciding on the location and nature of a potential eco-village. The site is the primary level of human intervention in ecological design and the environmental factors should therefore be carefully considered. Beer (1990: 3) states that individual site planning is an integral part of the overall land-use planning process: the detailed layout of an area of land should be planned so that it functions effectively in relation to a given range of land-uses on the site and around it. Any proposals for the development of a site should grow out of an understanding of the interactions between humans and nature on that particular site (Beer 1990: 10). This requires insight regarding the natural constraints and limitations, the extent to which flora and fauna will be conserved, the way people's primary needs will be met and way places will be created that are satisfactory to work, live and play in.

Kennedy (2004) states that the planning process must be flexible and sensitive, engaging the future residents in a participatory process. Eco-village designers should draw on lessons from many disciplines, including architecture, planning, wilderness planning, ecology, and landscape design to create as rich and diverse a physical and social landscape as possible. It is this multi-disciplinary approach that is vital to a successful design.

Other issues in the development of eco-villages, not to be addressed in this assignment, include: Infrastructure, design and layout, landform and topography, climate and microclimate, soils, water, and vehicle use.

4.3. RECYCLING – WATER, SEWAGE & WASTE

4.3.1. Water and sewage systems

The average person produces about 500 litres of urine and 50 litres of faeces per year, which together is termed as blackwater. When having access to tap water, a person produces an extra 20 000 to 100 000 litres of greywater (wastewater) per year (Otterpohl 2000:1). In current sanitation systems blackwater and greywater are collected simultaneously which leads to costly treatment and little opportunity for the reuse of water and nutrients. Water demand in these systems (conventional flush toilets) is high and pathogens and micro-pollutants are spread out in a high volume of water.

Ecological wastewater treatment has as its aims the efficient use and reuse of water, long-term soil fertility and protection of natural waters. As water and fertile land are vital to future generations, sanitation can play an important role in the quest for sustainable development. At the Global Water Forum in 2000 it was stated that there is no water scarcity, only mismanagement (Otterpohl 2000:6). It can be argued that conventional sanitation is a form of the mismanagement of water. Various technical options are already available to ensure more efficient nutrient and water cycles.

In many regions water supply is limited and future shortages are faced in many cities. Infrastructure and water supply comes under pressure as urban growth continues and seasons become drier as part of global climate changes (Roseland 1998: 54). The construction of additional reservoirs, dams and chlorinating plants as well as the maintenance of sewage treatment facilities adds to the cost of supplying citizens with enough clean running water. The environmental and financial cost of supply and treatment can be limited significantly by employing alternative solutions. More efficient use can be made of the available supply and the re-use of water can be furthered by using processes that enables recycling. A number of practical applications that provide these solutions are available and ranges from low- to high- tech.

One example of alternative waste management technology is the biolysis process. Described as an onsite aerobic method, this filtration process relies on bacterial organisms to decompose waste (Ecological Solutions 2002: 54). The Biolytix process, in its patented form, uses organic waste matter as a source of energy to the organisms. This results in a continuous digestion and re-digestion of solids, aided by the erosive action of flowing wastewater. Solid and liquid wastes are separated at source, and a vermiculture process is then used to treat solids (which can include putrescible kitchen waste).

4.3.2. Waste recycling

In today's society, waste is generated at an increasing rate as the desire to continually obtain new products motivates consumer behaviour. Products are regarded as waste long before their actual life span is reached. In modern lifestyles, recycling is often not regarded as an option, simply because of an overwhelming reliance on seemingly limitless resources. The waste created in this way comes at a large environmental cost. Apart from the finite resources that are depleted in the creation of consumer products and lifestyles, the environment is polluted by materials that are not recycled or decomposed and by the disposal of unwanted residue into the physical environment.

Current refuse removal practices rely heavily on the dumping of refuse in landfill sites. This not only requires large investment in land and treatment, but also signifies lost recycling opportunities. Mixed collection in compacting vehicles causes a maximum amount of household waste to be diverted to landfills. In a study performed in Brazil (Fehr & Calçado 2001) it was found that diverting waste from landfills is possible without abandoning existing technologies. The tested model is based on a system of divided collection which distinguishes between perishable or bio-degradable waste and dry or biologically inert waste. Perishable waste, which can be transformed into compost, represents 68% of the weight of household waste (Fehr & Calçado 2001: 3). By separating this from dry waste at the point of collection, composting as well as recycling is enabled without complex sorting procedures and a drastic reduction of landfill waste is possible. Bio-degradable waste is transformed into organic compost while dry waste is sorted into recyclable materials and refuse. In the study it was found that up to 84% of collected waste could be diverted from landfill in contrast to mixed collection (0%) and selective collection, where 16% of waste can be diverted (Fehr & Calçado 2001: 7). By employing this method, certain chemical treatments at the landfill site are also eliminated because of the absence of biodegradable refuse. It enables private initiatives in the sorting and recycling procedures and offers an administrative advantage to local authorities.

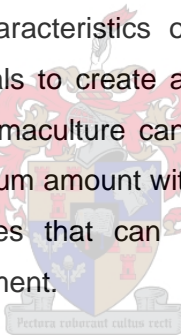
4.4. PERMACULTURE

Permaculture is an approach whereby knowledge of natural systems is combined with science. Natural ecosystems, typically resilient and dependent only on renewable sources of input, are used as architectural and botanical models for the design and structuring of human agro-ecosystems. According to EcoLogical Solutions (2003: 2) permaculture is a system of permanent, self-sustaining, consciously designed agriculture. Permaculture is adaptable to

both urban and rural situations and is designed to produce an 'efficient, low maintenance, optimally productive integration of trees, plants, animals, structures and human activities within specific environments' (Global Ecovillage Network 2003).

During 1974 Bill Mollison and David Holmgren developed a framework for a sustainable agricultural system based on a multi-crop of perennial trees, shrubs, herbs (vegetables and weeds), fungi and root systems. The word permaculture (a contraction of *permanent agriculture* as well as *permanent culture*) was coined to describe this approach in which architecture, biology, agriculture and animal husbandry is combined. Initially permaculture was seen as a beneficial assembly of plants and animals that would assist household and community self-reliance. It has developed into a 'human system' that encompasses legal and financial strategies, with an aim of providing strategies that are ecologically sound and financially viable (Mollison 1991: 1).

As permaculture emphasises the relationships in the landscape between the elements of plants, animals, buildings and infrastructure, it is an important influence in the design of eco-villages. It combines the natural characteristics of landscapes and structures with the inherent qualities of plants and animals to create a life supporting system of the smallest practical area (Mollison 1991: 1). Permaculture can be described as a cultivated ecology, which is designed to produce a maximum amount within the limits of ecology. This method of cultivation provides detailed principles that can be incorporated into the design and implementation of a sustainable settlement.



Gamble (EcoLogical Solutions 2002: 14) briefly illustrates a number of permaculture principles and their application in eco-village design:

- **Diversity**

Diversity should be evident not only in housing types and land sizes, but in the people of an ecovillage and its biodiversity.

- **Edge effect**

The interfaces between public and private realms should be carefully considered. Buffer zones can be created between development and natural areas.

- **Energy planning**

Cluster design together with the thoughtful use of internal energy (for example using slope and gravity to move water) and external energy (using trees and breezes as natural climate control) can bring significant energy savings.

- **Nutrient cycling**

In a natural system output is a resource for another process. This principle can be applied in ecovillages through composting toilets and recycling schemes for water, waste and refuse.

- **Scale**

Human-scale systems that are space and energy efficient can be achieved by using appropriate technologies for the population size.

- **Biological resources**

By using natural methods and process, energy inputs and wasteful outputs are minimised. Renewable energy resources, local natural building materials and 'people power' (for example walking and cycling) should be prioritised.

- **Multiple elements**

Various sources, for example of water, energy and communication methods should be available and a variety of techniques should be explored in the performing of a task

- **Multiple functions**

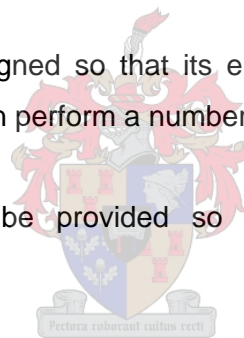
Eco-villages should be designed so that its elements like buildings, open spaces, water bodies and so forth can perform a number of functions.

- **Natural succession**

Adaptable spaces should be provided so that natural process can continue uninterrupted.

- **Relative location**

The placement of elements should take beneficial relationships into consideration. Self-sustaining systems, similar to natural ecosystems, can be created in this way.



4.5. RESOURCE AND ENERGY CONSUMPTION

It is generally assumed that the atmosphere is a 'free' resource. However the greenhouse effect and global warming have proved that this is not the case. Furthermore, energy resources are dwindling and the carbon economy faces increasing shortages in the future with severe economic implications.

Anderson (1993: 6) argues that there are two possible ways out of the existing carbon crisis, both involving a switch from fossil fuels to other sources of energy. One option is to move from the carbon economy to the nuclear economy, based on plutonium and uranium. The other way is to make greater use of renewable energy sources, based on solar, wind and wave power and also including greater energy efficiency and economic rules to limit the use

of the atmosphere. A decreased reliance on fossil fuels and a move towards a renewable economy, based on energy efficiency and renewable sources of energy would play a vital role in future development. According to statistics quoted by Eberhard and Van Horen (1995: 34), South Africa, although only responsible for 2 per cent of global emissions, emits far more carbon dioxide on a per capita basis than the global average. This is mainly because of the predominance of coal usage in the economy.

Eberhard and Van Horen (1995: 33) points out that, apart from the direct environmental impacts of coal mining and processing, the most serious environmental impact resulting from energy use patterns in South Africa occurs in the household sector. It has been mentioned that buildings are important energy consumers and as such directly and indirectly influence environmental deterioration due to dwindling fossil fuels and global warming. In ecological design, energy consumption can be lowered and impacts minimised by paying careful attention to the type of development, its location, layout, density, methods of heating and cooling, material use and land-use diversity.

One of the main priorities in ecological design is the energy embodied in building materials and subsequently in the building itself. When it is the primary aim to conserve energy, the cost of the building in both capital and environmental terms has to be reduced by decreasing the amount of energy that it consumes. Distinction can be made between energy conservation strategies and holistic energy-conscious design. Energy conservation involves energy efficient building technologies such as improved insulation, airtight construction, high-tech glazing and general energy saving actions. When aiming at a more comprehensive approach towards energy use, the building should not only be energy efficient, but should be made to last longer using materials that has a low embodied energy (Schmitz- Günther 1999: 10).

A number of considerations can lead to the improvement of energy conservation. In general the fossil fuels required to service a building should be kept to a minimum. The result is a reduced emission of carbon dioxide. At the same time, careful attention to design details can minimise cold bridging and incidental air infiltration. Efficient insulation improves thermal comfort, while the use of heat exchangers and heat recovery ventilation systems can recover a large amount of extracted heat from ventilation.

The generation of renewable energy on site is viable in some cases. Possibilities include the use of photovoltaic cells, which converts light energy into electricity, wind power and solar water heating. The climate of a site can be utilised in maximising the natural renewable energy sources available.

Energy-efficient design, according to Koch-Nielsen (2002: 12) is to be understood as design that minimises energy consumption in buildings by using natural methods to improve comfort conditions. This differs from design that relies on mechanical cooling and ventilation equipment that uses imported energy in its functioning.

As in the case of fossil fuels, the depletion of other material resources is taking place at an alarming rate. Storey and Baird (2001: 5) point out that of the materials used annually in buildings, only a fraction is not obtained from virgin sources. Demand is continually rising and according to some sources the current amount of building materials might, conservatively estimated, quadruple by the year 2020 (Storey and Baird 2001: 5). It is not possible to accurately assess the continued availability of virgin sources and alternative strategies for material use would have to be investigated and applied.

Goven (2003) emphasises the importance of choosing building materials carefully. The most obvious concern is the environmental impact of the materials on users (regarding both the interior and exterior of a building) and the resources that are depleted in the procurement process. Fair trade and human resource justice also play a role, as do user acceptability. Woolley *et al* (2000) distinguishes between organic, inorganic and fossil-organic materials. It is pointed out that from an environmental sustainability perspective the use of organic or renewable materials should be prioritised; the use of inorganic materials should be minimised while the use of fossil organic fuels should be avoided.

4.6. ADJUSTING METABOLIC INPUTS AND OUTPUTS

Gasson (2002: 13) states that it is being increasingly recognised that the transition to more ecologically sustainable urban-industrial metabolisms with reduced ecological footprints will require them to be restructured to imitate the processes of natural ecosystems. Particular attention should be given to the circular metabolisms of such systems. Greater use would have to be made of renewable and locally available resources while excessive and affluence-driven patterns of resource consumption must be reduced. Increased efficiency is required in the re-use and recycling of domestic and industrial wastes to reduce the pollution of environmental sinks.

According to Gasson (2002: 13) these requirements imply a different approach to planning, construction and management at a range of scales. In each case the most important objective would be the closing of metabolic cycles as much as possible. This can be achieved by a variety of spatial and non-spatial actions, some of which are listed in *Addendum B*.

CHAPTER 5: OVERVIEW OF ECOVILLAGES

5.1. INTRODUCTION

This chapter provides a short overview of a number of eco-villages. These have been created in widely different contexts and expresses varying ideals and development actions within the theoretical framework of eco-villages.

5.2. TLHOLEGO ECO-VILLAGE

5.2.1. Introduction

Tlholego Eco-village is discussed as an example of a local sustainable community initiative. All information, unless otherwise indicated, has been gained from the development's website (2005).

5.2.2. History, background and context

To address the challenge of rural sustainable development in South Africa, the Tlholego Eco-village was established in 1991 near Rustenburg in the Northwest Province. Situated on 150 hectares of land, the project is aimed at investigating ecological approaches to sustainability. By focussing on the key areas of tourism, education, sustainable agriculture and community development, Tlholego is currently developing an integrated model for rural settlements.

In collaboration with previously disadvantaged farm employees and other people from the area, one of the founders, Paul Cohen, set out to develop a 'rural living and learning centre' in which ecologically and economically sustainable lifestyles are promoted. The development has evolved through a process of applying ecologically sustainable approaches to land use, housing, food security and eco-village development.

Practical training in sustainable building technologies were started in 1994 by the founding residents of Tlholego and over a period of two years a series of experimental buildings were constructed. From 1996 to 2000 three prototype houses were built, incorporating solar hot water, compost toilets and rainwater collection.

5.2.3. Ecological design and infrastructure

Buildings

Locally available and recycled materials are used in the construction of experimental dwellings at Tlholego. Indigenous knowledge, in the form of traditional 2000-year-old Tswana designs, has been incorporated. Along with these earth and thatch constructions, buildings constructed from earth-filled bags with fired-brick dome roofs have been built. These experiments resulted in a sustainable housing system referred to as the Tlholego Building System.

The Tlholego Building System is described as a 'flexible, owner-built, low-cost, high-quality housing system'. According to the Tlholego website (2004), this system avoids the shortcomings of current low-cost housing construction while addressing environmental and resource problems that are not usually considered in standard South African housing developments.

The system makes use of the principles of sustainable building, natural waste treatment, and permaculture for enabling food self-reliance. A number of ecological design technologies have been implemented including passive solar design, the use of unburned mudbrick, appropriate technologies of rainwater collection, compost toilets, grey-water irrigation and solar water heating. Buildings constructed from earth-filled bags with fired-brick dome roofs have been built. The Tlholego project mostly makes use of mud bricks, which are sometimes reinforced with straw. Brick-making can be mechanised for larger schemes. Some experimentation is necessary to get the desired mixture of local soil, sand and clay. Finished walls are rubbed down with water and smoothed until all cracks disappear. A mixture of linseed oil and turpentine is then applied to make the walls more water-resistant. In terms of design, large roof overhangs keep houses cool and protect walls from driving rain.

The idea of using the labour, or sweat equity, of the end user of the building to reduce costs is not new. It is generally recognised that up to 50 percent of the building costs can be saved by owner building, even when using conventional materials. The degree to which savings can be achieved is dependent on the skill of the owner-builder, and/or the degree of skill needed for particular building materials or technique. Choosing appropriate materials and techniques will increase the savings. The careful selection of low-cost materials, which can be made or collected by the owner-builder, can be beneficial to any similar project.

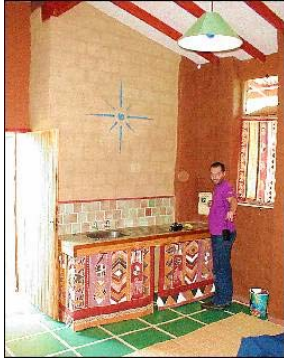


Photo 1a:

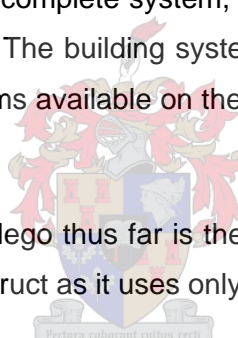
The interior of a completed building at Tlholego (2005)

Water and sanitation

In Tlholego roof water is collected and used for drinking and irrigation. Where water tanks are not affordable, roof water is canalised to vegetable gardens. Wastewater is similarly used for irrigation.

The Tlholego Building System, as a complete system, integrates on-site waste management for safely managing human wastes. The building system is designed to incorporate a range of natural waste management systems available on the market today, depending on the end-user preferences.

The main system developed at Tlholego thus far is the “Earthways Composting Toilet”. This system is low-cost and easy to construct as it uses only the most basic building materials.



Energy and resource consumption

An important aspect of Tlholego Building System is the choice of material. Materials are chosen so that the overall energy embodied in them, as well as the carbon emitted into the atmosphere during their manufacture, is minimised. This, together with the long-life of the buildings and ease of recyclability, produces a housing system that minimises the production of greenhouse gases, while providing a high-quality lifestyle.

Permaculture

There is a natural integration between the Tlholego building system and permaculture food security gardens that have been established in the immediate vicinity of the houses.

5.2.4. Social and governance issues

One of the important accomplishments thus far has been the sustained transfer of skills to Tlholego residents. Economically, the eco-village is driven by education, eco-tourism and sustainable agriculture.

5.2.5. Conclusion

Over the past ten years, Tlholego has accumulated considerable knowledge about sustainable building technologies. The result is a small, but competent building team, capable of building new houses at Tlholego, as well as training other communities and people from around the world. The Tlholego Building System can be applied across various sectors of the housing market and there is plenty of flexibility to allow for designs to differ according to different contexts.

5.3. THE FINDHORN FOUNDATION

5.3.1. Introduction

The Findhorn Foundation Community Ecovillage in Scotland is one of the earliest and largest intentional communities. All information, unless otherwise indicated, has been gained from the development's website (2005).

5.3.2. History, background and context

Since 1962 the Findhorn Foundation has experimented with new models for holistic and sustainable living. Situated in the north-east of Scotland, the Foundation has for decades been working with nature under adverse conditions. It is currently working on the largest intentional community in the United Kingdom, the rapidly developing Findhorn Foundation Community Ecovillage Project. Started in 1980, the community is comprised of more than 400 individuals who live and work in this rural area.

5.3.3. Ecological design and infrastructure

Various construction methods have been utilised. One method makes use of natural materials, which is incorporated into a 'breathing wall'. This allows the fabric of a building to breath and thereby moderates humidity and air quality. There have also been experiments with other ecological solutions such as straw bale construction and a system using recycled car tyres as building material.

Buildings

Nearly 30 ecological buildings have been constructed and 40 more are planned. In general use is made of 'breathing wall' construction that allows a controlled exchange of air and vapour, and eliminates the need for a conventional vapour barrier. Suspended timber floors allow for air circulation to prevent any possible build-up of radon gas. Non-toxic organic

paints and wood preservatives are used throughout as are boarding manufactured without the use of toxic glues or resins. Electrical circuits are isolated to reduce electromagnetic field stress. Simple timber frame construction and detailing makes self building possible. Shared facilities, such as laundries, kitchens and lounges are encouraged to avoid unnecessary duplication.

Where possible local materials, such as stone, is used for pathways and paving. Locally grown and harvested timber from managed forests is used, while roofing is made of natural clay tiles.



Photo 1b: Some of the ecologically designed buildings at Findhorn

Water and sanitation

Water conservation is exercised by employing water saving devices for showers, toilets and taps. Rainwater is collected and water recycled as far as possible for garden use.

Energy and resource consumption

Passive solar features, like orientation and window placement, are used where possible. Solar panels are used for domestic hot water heating. There is a district heating system that uses a gas condensing boiler for fuel efficiency. Cellulose insulation (made from recycled paper) prevents heat loss. This is aided by triple glazing.

Waste and pollution

An extensive recycling programme have been implemented which recycles metal, glass, paper, and batteries, and includes a clothing bank). This has been instrumental in encouraging local authorities to expand the range of recycling services to the local area.

5.3.4. Social and governance issues

A diverse social fabric has emerged within the Findhorn Foundation Community over time. Community participation has been an integral part of the project. The Community has been involved not only in the erection of buildings, but with the development of decision making,

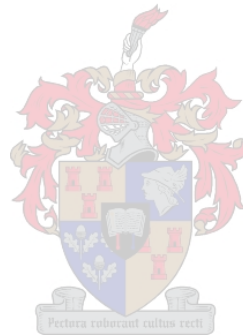
governance and leadership, festivals and celebration, and experiments with pay and remuneration.

In 1999 the New Findhorn Association was formed to bring together all the diverse organisations and people within a 80 km radius associated with the Findhorn Community. The New Findhorn Association has an elected voluntary Council, but control of all aspects of the Association's affairs lies with its membership, through various democratic processes. The Council's role is to facilitate communication across the community and to empower grassroots members to provide services for themselves through co-operation, private enterprise, sub-contracting, leasing and other means.

5.3.5. Conclusion

The Findhorn Community's work with the environment is based on the premise that new strategies for sustainable life on Earth must incorporate fundamental changes to the way we relate to ourselves, one another and to nature. As such it serves as a useful resource for knowledge in this regard.

5.4. CRYSTAL WATERS



5.4.1. Introduction

Crystal Waters is one of the best known intentional communities. All information of Crystal Waters, unless otherwise indicated, has been gained from its website (2003).

5.4.2. History, background and context

Crystal Waters, situated 100 kilometres north of Brisbane, Australia, was established in 1988. Designed and developed by a company called EcoLogical Solutions, its intention was to create a socially and environmentally responsible settlement on the 259 hectare property. Its rural context is supplemented by the expected urban amenities such as reticulated water, electricity and communication links.

Under Australia's local subdivision laws a number of commercial lots have been developed on about 14% of the land (see *Figures 4 and 5*). The optimum population for Crystal Waters was calculated at approximately 300 residents. Lindegger (1997: 2) mentions that even though the density of 300 people on 259 hectare does not seem that high, it is relatively high in terms of Australia's conventional subdivisions. Initially only a proposal of sixteen sites

would have been accepted, which is considerably less than the 85 sites that have so far been developed. Crystal Waters is currently home to about 200 People. The optimum population is believed to be around 300, which allow a viable internal economy. Zoning allows home industries, which assists in time and energy savings. The Crystal Waters Community Co-operative owns 6% of the land, which zoned for commerce, light industry and educational activities, while the remaining 80% of the property is owned in common by residents.

5.4.3. Ecological design and infrastructure

Infrastructure

In Crystal Waters various design aspects have been taken into consideration in the provision of infrastructure. Although simplistic, all the actions have positive cost and ecological implications. The roads are narrower and do not have kerbing, thereby saving on construction and management cost. Runoff drains back to the land. The internal roads are maintained by the community. The narrow roads and speed limit encourages the use of non-motorised transport. Combined service trenches are used for all power, water and telephone lines. The mains power supply to Crystal Waters is less than that supplied to normal subdivisions, therefore lightweight cables that costs less, could be installed. As all residents are responsible for their own sewerage, no main sewerage lines were installed.

The choice of land used for buildings were carefully considered. Aspect is an important determinant in the location of buildings – all houses are to have a generally northern aspect to make the best use of solar potential. Other considerations were the slope of the land and its ability to absorb human waste safely. Land with agricultural potential and significant environmental areas was kept as common land.

Buildings

Although residents are free to design their homes according to their needs, ecological design considerations are encouraged. These include the consideration of materials' origin; the effect that materials might have on occupants; the impact of future demolition of the building on the environment; and the placement of the building on the site to maximise solar gain.

A variety of construction techniques and materials are evident in Crystal Waters. Local timber together with natural paints and finishes, rammed earth, straw bale construction, mudbrick domes, poured earth and other recycled materials are some of the components of buildings here. In the case of the rammed earth buildings, the walls of approximately 300 mm provide

good insulation, while a large roof area is designed to collect rainwater and provide shade. Building materials are free of chemicals as far as possible.

Water and sanitation

Atkisson (1991: 15) points out that water was considered perhaps the most important design criterion. Drinking water is provided by roof-trapped rainfall collection systems, while utility water is drawn from holding tanks fed by a creek that runs through the property. Water collected from local watercourses provides each household with access to 1000 litres of internally reticulated water per day. Dams are planned to create ponds for recreational use, flood mitigation, aquaculture, and positive micro-climatic effects. The area in which Crystal Waters is located has a long dry season and water has to be carefully conserved. The reticulation system is also designed not to adversely affect the water quantity or quality downstream. Dams were constructed as a back-up supply for irrigation, household use or for emergency fire fighting. It also offers recreational possibilities and serves as habitats for wildlife.

Each household is responsible for the treatment of its own waste. A variety of composting processes are generally used in the treatment of sewerage. This maintains nutrient flow and water re-use. Water is seen as a resource, and like other resources, is recycled where possible.

Energy and resource consumption

It is mentioned by Atkisson (1991: 15) that electricity still comes from local utilities, but in limited quantities - about 2000 Watts per household. It is up to individual household to employ energy-saving mechanisms where it is possible. Most rely on low-energy lighting, energy efficient wood heaters, solar power and reduced energy consumption patterns. They are also encouraged to consider installing photovoltaic systems and battery banks, with access to main utility power as a back-up. Good insulation design and ventilation provides natural climate control.

Waste and pollution

Metals, glass, plastic and organic materials are recycled as far as possible in order to save money and reduce the impact on landfills. A direct relationship between consumption and waste exists as residents are responsible for the provision of their own needs and the disposal of waste.

Permaculture

It is mentioned (Ecological Solutions 2002: 12) that Crystal Waters was the first village in the world to be consciously designed according to permaculture principles. The land on which the eco-village is situated was first cleared in the 1960's and became degraded and eroded due to excessive animal grazing. Through the application of permaculture design, much of the land has been transformed to its original quality. According to documentation (Ecological Solutions 2002: 9), an increase in flora and fauna is noticeable and the quality of the land has improved. While the land productivity has increased, a balance is being maintained between food production, housing and wilderness.

5.4.4. Social and governance issues

Crystal Waters is culturally diverse. It is stated (EcoLogical Solutions 2002: 13) that 16 nationalities and various age groups are represented by the residents. Care has been taken in designing the settlement so that social interaction is encouraged. An internal telephone system, newsletter and notice boards keep residents in touch. About 80 of the residential lots are clustered to enable 'neighbourly interaction, co-operation and a sense of belonging' (Global Ecovillage Network 2003: 2).

While community life is very important to villagers, the emphasis at Crystal Waters is very much on physical design. There are rules regarding social behaviour, but no clear structures exist for enforcing them, according to Atkisson (1991: 15). Instead the community uses "a combination of adulation and peer pressure," together with discussions. A number of by-laws act as guidelines for sustainable living.

5.4.5. Conclusion

In most respects Crystal Waters is an efficient and well-functioning model community. Lindegger (1997: 2) points out though that there are aspects about Crystal Waters that can be improved. It is felt that the eco-village has not yet reached its full potential and that there are opportunities for improvement. Areas highlighted in this regard include job creation, recreational facilities for young adults and the application of management skills to community issues.

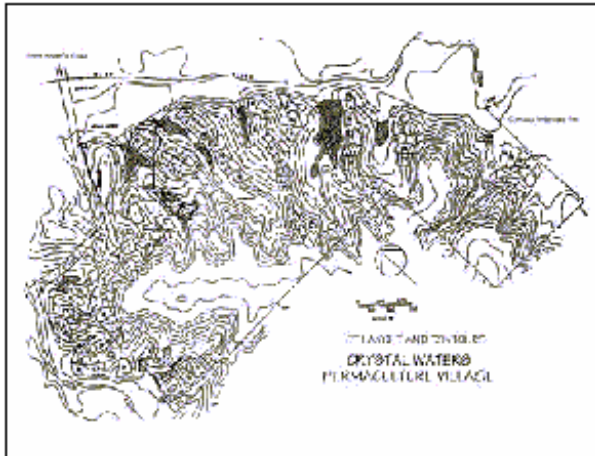


Figure 4: Topographical map of Crystal Waters

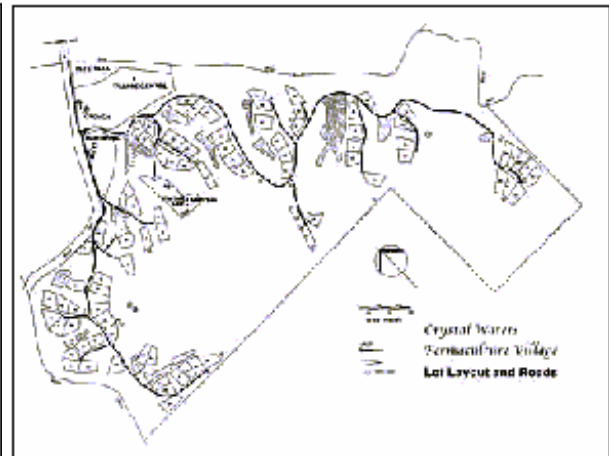


Figure 5: The residential layout of Crystal Waters

5.5. LOS ANGELES ECO-VILLAGE

5.5.1. Introduction

The Los Angeles Eco-village is an example of an inner city neighbourhood that functions according to ecological principles. According to Arkin (1993: 1) the Los Angeles Ecovillage came about through small actions and seemingly unrelated events. It serves as an example of how an inner-city neighbourhood can be retro-fitted to conform to new standards of ecological living.

Several initiatives have led to the creation of a fairly sustainable urban area. These include greywater projects, energy and water conservation demonstrations, organic gardens, a community-supported agriculture movement, and an ecological home movement. Further efforts include the restoration of a local river, paving reduction, urban forestry, and the prevention of various freeways and street widening. Unless otherwise stated, all information is available in the article by Arkin (1993).

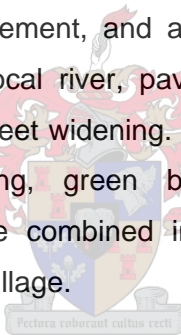
5.5.2. History, background and context

The Los Angeles Eco-Village concept was developed by the Cooperative Resources and Services Project (CRSP), of which Lois Arkin is the founder and executive director. Initially the project was planned for an 11-acre city-owned landfill site and its adjacent neighbourhoods about seven miles northeast of the current location. However the focus recently shifted to an inner-city neighbourhood. The group intends to maintain the neighbourhood's mix of cultures, income groups, family structures, and lifestyles.

Three miles west of downtown Los Angeles this two-block mixed-use neighbourhood is home to approximately 500 people in about a dozen buildings. It is an established mixed-use neighbourhood with good access to public transportation and job opportunities.

The decision to retrofit the neighbourhood evolved out of a commitment to participate in the regeneration of Los Angeles. It was the aim of those involved to effectively introduce whole-systems planning to provide a model of sustainability in neighbourhoods that have already been built up. Issues of urban development and open spaces were addressed in the process. It was felt that Los Angeles was inappropriately developed. In the view of those involved, the existing commercial corridors, with miles of single-story development and strip malls, could be transformed into more user-friendly (and environmentally-friendly) three- to five-story compact mixed-use areas interspersed with open space along tree-lined sidewalks with bicycle, pedestrian, and mass transit-friendly streets.

Several initiatives have led to the creation of a fairly sustainable urban area. These include greywater projects, energy and water conservation demonstrations, organic gardens, a community-supported agriculture movement, and an ecological home movement. Further efforts include the restoration of a local river, paving reduction, urban forestry, and the prevention of various freeways and street widening. There are moves toward affordable and cooperative housing and co-housing, green businesses and ecological economic development. All these elements are combined in a single sustainable neighbourhood demonstration, the Los Angeles Eco-Village.



5.5.3. Ecological design and infrastructure

Infrastructure

The implementation of waste-to-resource systems, retrofitting adjacent commercial strips to mixed-use residential and commercial, retrofitting buildings with non-toxic regional and recycled building materials, and operating community-owned non-polluting vehicle pools are also considered.

Extensive street-calming to slow the traffic is to be part of this development. This includes the unpaving of some traffic lanes for open-space community uses. An intersection of two four-lane streets in the neighbourhood is to be transformed into a plaza that will be able to accommodate various functions.

Housing

A major feature planned for the Los Angeles Eco-Village is the acquisition of existing apartment buildings for conversion to permanently affordable, cooperative ownership for the community's low- to moderate-income current and future residents. Some of the buildings will lend themselves to co-housing and other collaborative housing arrangements. Buildings are to be retrofitted with non-toxic regional and recycled building materials. A city law that will protect neighbourhoods such as this from gentrification is being promoted. Without such a policy, increasing a neighbourhood's sustainability will also increase the value of real estate, driving out the very people who improved the area.

Water and sanitation

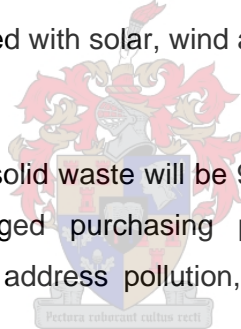
It is estimated that planned water conservation and biological grey water reclamation could cut water use by 85 percent.

Energy and resource consumption

It is estimated that retrofitting buildings for energy efficiency can reduce conventional energy requirements by about 75 percent. This will be done through passive solar design, conservation and efficiency, combined with solar, wind and biomass technologies.

Waste and pollution

It is estimated that landfill-destined solid waste will be 90 percent lower than average for the Los Angeles area through changed purchasing patterns, community recycling and composting, planners envision. To address pollution, a pool of non-polluting community-owned vehicles is to be used.



Permaculture

Organic urban agriculture, an orchard, and community composting have already begun within the neighbourhood; rooftop and vertical gardens will be added as it becomes viable. Residents are to raise up to 40 percent of their food organically.

5.5.4. Social and governance issues

Arkin feels that American environmental legislation and land laws are fragmented and that a holistic approach to integrate humans and the environment is required (Ruben and Harris 1992: 1). This fragmentation is evident in the separated land uses and social divisions that exist. It is in an attempt to remedy this situation that Arkin is shaping her vision of the urban eco-village. Arkin emphasizes the importance of pulling the people together first when planning a community and also involving the larger neighbourhood. She and other

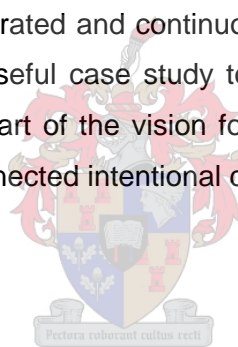
community planners are now surveying neighbours of the site to find out their concerns and ideas for the eco-village.

The area in question is described as an established mixed-use neighbourhood with diverse social, ethnic, and income groups. The proportion of Asian, Latino, Anglo, and African-American residents are balanced. The population of the neighbourhood (around 500) is a small enough number to ensure that people know each other and that decisions involve everyone. Regular newsletters and community meetings keep everyone in touch.

Plans for economic systems include a credit union, socially responsible investment opportunities for neighbours and others, and non-polluting livelihood opportunities through a community-owned neighbourhood "Eco-Business Incubator". A Local Exchange Trading System and community revolving loan fund are already established.

5.5.5. Conclusion

Although not developing in the integrated and continuous way as a greenfield development, the Los Angeles Eco-Village is a useful case study to realise the opportunities that exists within existing urban settlements. Part of the vision for Arkin (1993) is to see Los Angeles developed into a number of interconnected intentional communities.



CHAPTER 6: LYNEDOCH ECO-VILLAGE

6.1. INTRODUCTION

The necessity of addressing environmental problems have been discussed in this assignment, as have South Africa's need of an integrated society, both physically and socially. Together with these issues, the provision of housing for farm workers within and in close proximity to the rural work areas have become of utmost importance (Winelands District Council 2000: 4). The Lynedoch Eco-village aims to address these issues by creating a sustainable settlement in the Stellenbosch area. All information in this chapter, unless otherwise indicated, has been gained from the Sustainability Institute website (2005).

6.2. HISTORY, BACKGROUND AND CONTEXT

The non-profit Lynedoch Development Company (LyneDev) was started in 2000 with the intention to create the first ecologically-designed and socially mixed intentional community in the country (Swilling and Annecke 2004: 1). This was to be done by creating a village of medium density that could accommodate workers from surrounding farms as well as other interested potential residents. For this purpose the old Drie Gewels Resort in Lynedoch near Stellenbosch was bought in 1999 as it was facing bankruptcy.

The Integrated Development Framework for the region at that time called for contained high density hamlets across the Winelands region as a means of managing long term urban growth (Winelands District Council 2000: 5). Such controlled development is thought to curb the urban sprawl and related environmental destruction normally associated with development. As the population in the Winelands is expected to grow substantially over the next 15 years, urban planners have recognized that if this is all concentrated in large towns where densities in formal areas are low, the result could easily be the suburbanisation of an agricultural region that could negatively affect agriculture, the ecology, urban infrastructure and the tourism industry while simultaneously exacerbating rather than eliminating poverty (Sustainability Institute 2005). It is in this context that the Lynedoch development was initiated as an alternative that could set a precedent for a type of settlement where growth could be accommodated without fundamentally compromising the regional character of the area.

The vision of the Lynedoch Development Company is the creation of an inclusive 'living and learning community' that could become a demonstration of sustainable living (Swilling and Annecke 2004: 1). This involves not only the promotion of energy efficient and ecologically

sound resource use but also the attainment of social justice by providing equitable access across diverse affordability levels.

The first municipal application for the establishment of an “agri-village” on Farm 468/40, Drie Gewels, was considered by the former Winelands District Council in November 2000. It comprised an application for the rezoning, subdivision, consent use, departure and establishment of a Home Owner’s Association. However the submission was refused. According to the council, this was due to the fact that planning of the hamlet and the realisation of long-term goals of the Winelands Integrated Development Framework could have been compromised should the development be favourably considered prior to the hamlet planning being finalised. It was stated that the application would be reconsidered once the planning of the hamlet at Lynedoch has progressed sufficiently (Winelands District Council 2000). Approval was finally secured in May 2002 after an appeal process.

Swilling (2004:1) identifies three goals that were formulated to guide the process.

- The Lynedoch Eco-village must be a mixed community organised around a child-centred learning precinct.
- The Eco-village should strive to be a working example of a liveable ecologically designed urban system.
- The Eco-village should be a financially and economically viable community that is not dependent on external funding to sustain itself.

The key features that will enable the Lynedoch vision to become reality (as summarised by Swilling and Annecke 2004: 1-2) include:

- A primary school for 400 children
- A pre-school for 40 children
- A large multi-purpose hall
- Offices and classrooms for the Sustainability Institute
- 30 residences that provide accommodation for participants in Sustainability Institute programmes, including sabbaticants
- 42 housing units catering for middle to low income families from all communities (Phase 1)
- Commercial space for offices or small manufacturers
- A village green laid out in accordance with permaculture principles
- On-site treatment of sewerage for re-use for irrigation and re-use in the houses
- Energy saving, including renewable energy.

6.3. ECOLOGICAL DESIGN AND INFRASTRUCTURE

A number of ecological design approaches are followed at Lynedoch to reduce the overall footprint of the development.

Infrastructure and layout

The general concept for the Lynedoch Eco-village layout is based on small individual erven around multi-functional public spaces. These spaces would vary in size, from small play and parking areas to larger public squares (Winelands District Council 2000: 2). The residential density was planned at 30 dwelling units per hectare, which is relatively high for a rural area. The idea is that this would set a precedent for higher density, contained settlements in the area. Constraints will be placed on the movement of motor vehicles via pedestrianisation measures that will include cycle paths, protected leisure spaces where children will be safe, and speed reduction measures.

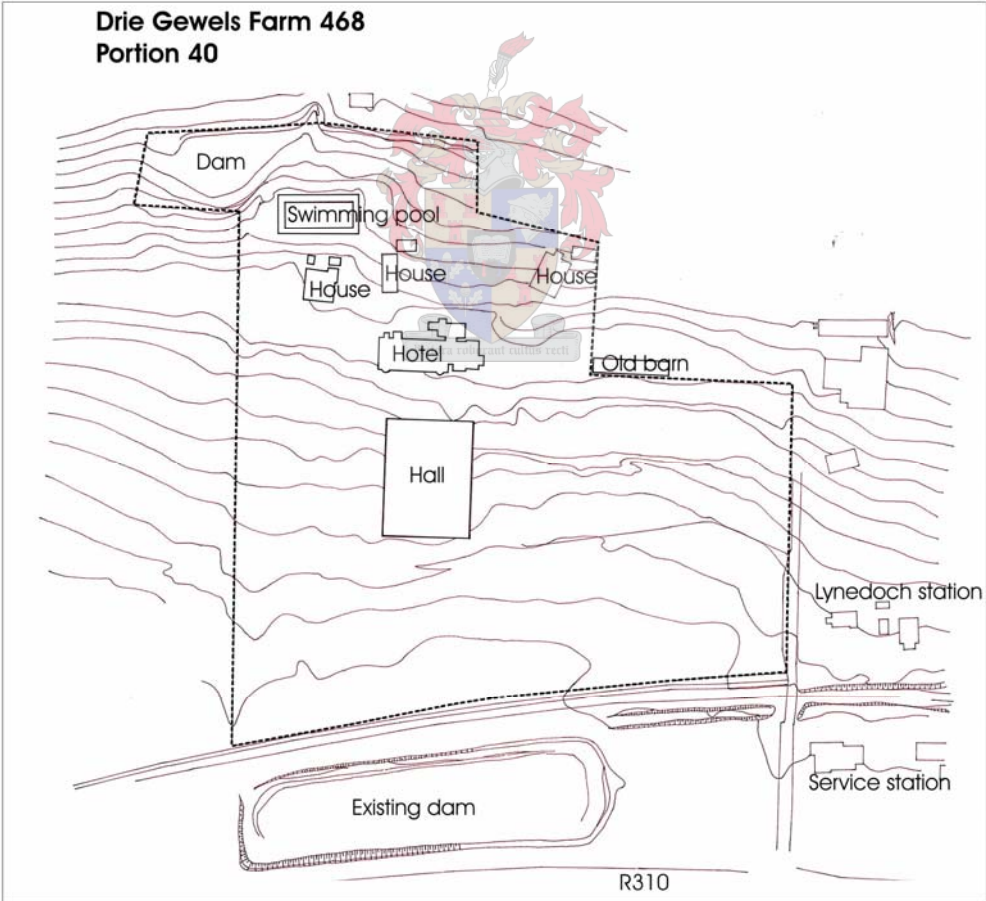


Figure 6:
Context of the Lynedoch Eco-Village

During the course of the development process at Lynedoch, the intended physical outcome has changed a number of times. In the initial plans provision was made for 8 single dwellings, 144 town houses, 1 block of flats, 3 sites for offices, 1 site for the school, community hall and other facilities, 1 crèche site, 1 swimming pool erf, 1 erf for tennis courts, 5 public open space erven, the biolytic waste site and the general street area. As the development is seen as an organically growing hamlet as opposed to a complete development, adaptations have been made over time to reflect the changing conditions and circumstances that arose (Rendell 2003). This is illustrated by the different versions of layout plans that have been designed for the Eco-village (see *Figure 7*)

Buildings

The Lynedoch development site has existing infrastructure and buildings which have been adapted to suit current requirements. The main building, which houses the Sustainability Institute and the Lynedoch Primary School, is one such example. It has been adapted according to ecological principles and displays a number of ecological features. Its interior walls are made from unfired clay brick manufactured on site from excavated materials. Passive heating and cooling takes place by means of an underfloor rock store linked to a low energy air circulation system. This allows the passive adjustment of temperatures in the school building during winter and summer. The hall is cooled in summer via wind chimneys on the roof that draw the prevailing South Easterly wind down into the building.

According to initial plans, five housing types, ranging from single residential dwellings to semi-detached houses and terrace housing, were proposed. The technology to be used in construction will be ecologically sustainable and energy efficient, for example the patented unfired clay bricks that are made on site. Although a number of alternative building materials were explored, there was decided on compressed unfired clay bricks since it is SABS approved and simplified the approval of a bond. This technology uses material from the site and functions according to a “rammed earth” principle. Together with orientation and energy efficient design, these clay bricks provides improved thermal performance.

A “decision-support” tool is being developed to simplify the selection of suitable building materials according to criteria of low embodied energy levels, benign toxicity, positive environmental impact, long-term low cost durability and recyclability and/or biodegradability.

Water and sanitation

It is intended that no water will leave the boundary of the Lynedoch site where possible. By means of a variety of water harvesting and re-use methods, an estimated 40% water saving is expected (Sustainability Institute 2005). To enable such efficiency, the water and sewage

systems of Lynedoch Eco-village had to address two objectives. Firstly, that effluent should be treated in such a way to maintain nutrient flow; and secondly that the treated water should be put back into the household and landscape.

Such a dual water supply system would mean that potable water is supplied for personal use, while recycled water is available for toilet flushing and irrigation. All plumbing fittings are to have water saving mechanisms, for example low flush or dual toilet systems and low pressure shower heads. Rain harvesting at household level is optional.

On-site sewerage treatment is to take place via a system that includes septic tanks, a biolytic filter, a vertically constructed wetland and two dams. The primary sewage treatment takes place in the septic tanks, while secondary treatment is done by a biolytic water treatment plant and a constructed wetland. The Biolytix system was installed to handle the effluent of initial buildings. This on-site vermiculture-based waste treatment system treats all liquid and organic wastes on site. The resultant effluent is useful as fertilizer. Of the effluent entering the system, 10 kilolitres of the nutrient and nitrate rich product would be kept for use as fertilization. The remaining approximately 30 kilolitres would enter the wetland and would be disinfected and recycled through ultra-violet treatment. The Biolytix technology and the vertically constructed wetland allow rapid, odour-free environmentally appropriate filtration without the use of chemicals. The filtrate can be recycled for irrigation or other uses. Nutrient removal takes place via the vertically constructed wetland and the dams which makes it possible to re-use the effluent for flushing, irrigation and domestic clothes washing.

Stormwater run-off is to be minimised by restricting hard landscaping that will improve percolation into the ground. The remaining stormwater run-off is to be conveyed in open channels that will complement the natural character of the development. These channels will drain into the Eerste River or can be diverted into the dam if required

Energy and resource consumption

The provision of sustainable energy is an important aspect of any ecological development. In the case of Lynedoch the aim was to incorporate best-practice features for sustainable design in housing delivery.

The underlying principle of the energy supply approach was to understand the operational needs of the householders and users. A range of options for meeting these needs was then investigated within a framework of criteria for environmental sustainability. These criteria, as mentioned by Morris (2002: 2) included financial efficiency and affordability.

ESKOM electricity is to be reticulated for each house. As buildings are designed according to passive heating and cooling principles, the need for electrified space heating and cooling is reduced. Appropriate natural landscaping acts as self-organising thermal management systems. Water heating is to be done via solar panels instead of electrified geysers, which can reduce reliance on coal-generated electricity by 60% (Morris 2002: 4). Liquid petroleum gas hobs will be used for cooking. A solar generated power source for stoves is under investigation and might be implemented. Efficient insulation and orientation is to aid in space heating. For both street and domestic purposes, low energy lighting in the form of compact fluorescent bulbs is specified.

Waste and pollution

Recycling of refuse in the Lynedoch Eco-village is to be done at household level, where members are required to separate their refuse into five separate containers (Sustainability Institute 2005). The collection of separated refuse and the possible reselling of some of it, is to be entirely co-ordinated by the Home Owners Association. The community-based waste collection and recycling system is operated by a local empowerment firm that separates collected waste at a local depot into discrete waste streams. This means that only 5% of the waste stream is currently being transported to a landfill site. Organic waste is to be processed in a composting depot that will benefit the eco-village. In all respects a principle of “zero waste” is to be followed.

Permaculture

The landscape and gardens of the eco-village are designed in accordance with permaculture principles. Existing vegetation is to be retained and supplemented with indigenous planting. The landscaping programme includes fruit trees, organically grown vegetables and medicinal plants (Winelands District Council 2000: 2). A permaculture-based landscape will provide a user-friendly network of green areas connected to food lots (irrigated by the effluent from the biolytic filters) that generate organically grown food.

6.4. SOCIAL AND GOVERNANCE ISSUES

A vital part of the Lynedoch development is the social composition of the future community. This development is one of the first in South Africa that actively works towards a socially mixed community. The project will have a significant social impact on the lives of farm employees of the area, as the Eco-village is set to provide access to resources, proximity to work and a sense of community.

The general management and administration of the Lynedoch Eco-village is to be the responsibility of a Home Owners Association, a Section 21 Company constituted as a separate entity from the Lynedoch Development Company. This body is responsible for general management and administration, including maintenance of buildings, services and amenities. Each property owner will be a member of this association and will contribute financially in the form of a levy for sewerage, water and refuse removal. The only involvement of the local authority is the supply of potable water.

The R3 million loan by the Development Bank of South Africa was used to build the water, sanitation, electrical, road, telecommunications and stormwater infrastructure. After the sites were sold, the revenue was loaned out again to people who qualify for a housing subsidy. This has given rise to an innovative way of mixing housing subsidies, finance for bulk infrastructure and end-user finance within a mixed income development.

6.5. DEVELOPMENT PROCESS

The first meeting with potential residents was held on 27 February 2002 after the proposal was advertised in the media. During this session the following details were set out. At that time the development comprised of 115 plots, but approval had been received for 144 plots. The cost of the plots were worked out according to size and location and started from R375/m². The house sizes ranged between 40m² and 128 m². For the largest house type a price estimate of R386 000 were calculated, while the smallest would come in at R114 000. These small units were intended for owners that qualified for a government or employee subsidy .

By 2003 the relevant government departments have approved the various technical aspects of the development. The Development Bank of South Africa agreed to fund the infrastructure costs of the first phase of development. This phase was to consist of 42 houses which cater for the full spectrum of housing needs, including farm employee accommodation and private buyers (Sustainability Institute 1995).

During January 2004 the infrastructure construction began and was completed by September. This meant that the transfer of 42 sites to the new home owners could take place and that construction on the houses could start in January 2005. The final group of home owners are a mixed group from all backgrounds and age brackets. Due to the fact that some people have bought double stands and two of the stands will be bought by the Sustainability Institute for residences, 32 houses will be built. Of the 32, 16 have been sold at one fifth of the market price to people who qualify for a government housing subsidy. The remainder of the sites have been sold at market-related prices to people from diverse backgrounds. The

subsidy sites form part of the village and are not located in a separate space. A range of different kinds of businesses are being set up, including tapestry weaving, a renewable energy consultancy, a Guest House for visitors, a community bank, and farming amongst others.

The group of homeowners requiring subsidies meet regularly. To overcome challenges in the South African housing subsidy scheme, a Peoples Housing Process is to be started, where the entire group participates in providing labour for building. In January 2004 the first meeting of the entire group of purchasers took place and the process of setting up the Home Owners' Association was begun. The founding meeting for the HOA took place during May 2004.

The first house made of adobe brick (unfired clay brick made of clay and straw measuring 300 mm wide) was completed during May 2005. The construction process has been set up as a training programme which means all the labourers and artisans involved will be learning about sustainable construction and they will all get certificates accredited via the Construction SETA to prove their competencies. The training programme generates funds that reduce the labour cost. Government subsidies have been secured for those who qualify for government subsidies. The Provincial Government and the local Municipality have been very supportive of the clay construction approach mainly because it demonstrates that it is possible to build large decent houses at affordable prices. Whereas the average house being built by government using conventional technologies is between 30 and 45 m² at over R1000/m², the Lynedoch project demonstrates that it is possible to build 70 m² houses for R1000/m² including roof insulation, internal and external plastering, internal water and sanitation, solar water heater, and an internal electricity connection. Whereas the average cost of the cheapest building material (cement hollow block) is around R100/m² of wall, the average cost of an adobe built house is R40/m² of wall. However, the longer term operating costs are much lower because it will be cool in summer and warm in winter.

6.6. CONCLUSION

In response to a context of globalisation, depletion of strategic natural resources, technological change, the biotechnology revolution, urban agglomeration and mass communications, communities like Lynedoch are forging local economies where essentials like food, jobs and safety are secured through joint action between local associations, small businesses and democratically accountable local governments (Sustainability Institute 2005).

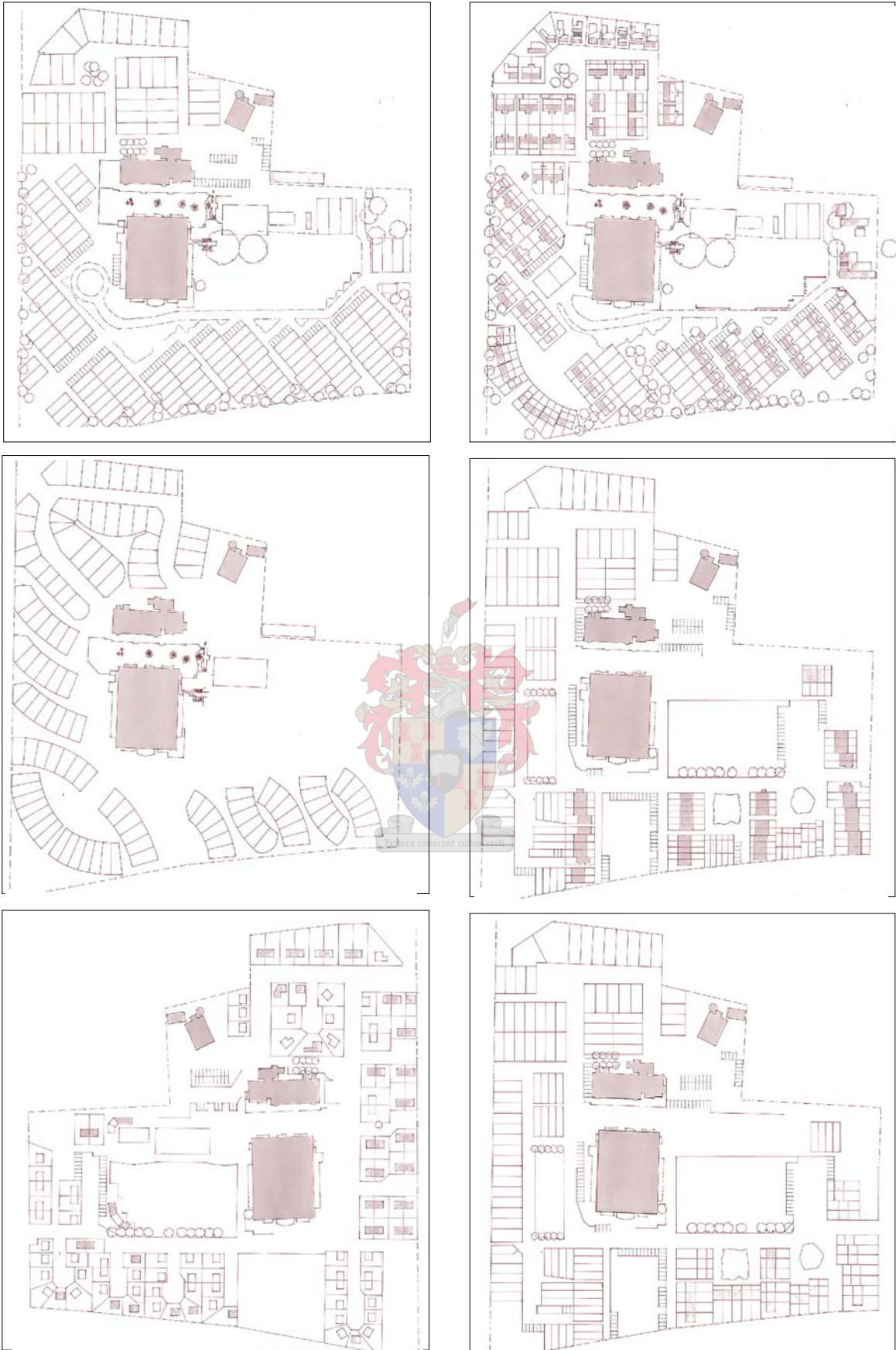


Figure 7: Different layout options for Lynedoch Eco-village

(Adapted from Rendell 2003)



Photo 2
The Drie Gewels guest house



Photo 5
The First 40m² experimental house



Photo 3
Interior of the multi-purpose hall



Photo 4
The Biolytix treatment area



Photo 6
The main building housing the Sustainability Institute and primary school



Diagram 7
Artist's impression of the original Lynedoch Eco-village scheme

Photo's 2- 6 and Figure 8: Lynedoch Eco-village (Lynedoch website 2005)

CHAPTER 7: INFLUENCE AND POTENTIAL OF ECO-VILLAGES

7.1. THE RELEVANCE OF ECO-VILLAGES

It has been mentioned a number of times that eco-villages have the ability to provide lessons in alternative development practices. To understand how new urban development can take place and existing settlements retrofitted in a sustainable manner, it is of value to look at the specific relevance of eco-villages.

7.1.1 Mixed use, compact settlements

In the face of limited resources and a context of rapid urbanisation it is increasingly clear that careful thought is required about the way that development of urban environments takes place. Rogers (1997: 38) points out that the creation of compact, efficient cities would principally require the rejection of single-function development and the dominance of the car. In this respect eco-villages can serve as smaller experimental versions of compact, mixed-use and pedestrian-oriented communities.

In South Africa, the concept of compact cities poses additional challenges. In most cases, it is not only a question of densifying existing urban landscapes, but of reconnecting separated areas. This creates the opportunity for infill development to reconnect segregated communities. Such new developments can potentially aid the creation of more efficient urban environments. Beatly (2000: 46) refers to examples in Amsterdam, where urban redevelopment on infill sites has led to compact new urban villages that contains growth within the city's boundaries.

A strategy of higher residential densities with mixed-use development not only protects rural land and limits sprawl, but enable strong social centres and distinct communities. Denser building configurations can also enhance climate control.

7.1.2 Innovative approaches

Van Der Ryn and Cowan (1996: 10) refers to the fact that city planners, engineers and other design professional have become reliant upon standard solutions that fail to consider the health of human communities or ecosystems. These approaches usually require unnecessary expenditure of energy and resources; this despite the availability of alternative technologies. Eco-villages and other innovative settlement designs can create awareness in this regard and can illustrate how new energy-efficient and environmentally-friendly technologies can be applied. Eco-villages particularly have the opportunity to highlight the

value of “green” architecture and development. With fewer restrictions on land use and building codes, rural eco-villages can experiment more with alternative technologies

7.1.3 Retrofitting

To attain a suitable level of urban sustainability, it would not be sufficient to merely focus on new settlements. A vital difference can be made by retrofitting existing settlements to conform to relevant standards. Eco-villages, as can be seen in the Los Angeles Eco-village, can illustrate ways of transforming existing areas, or ‘brownfield’ sites into physically and socially responsible communities.

7.1.4 Resource consumption

It is generally agreed that water shortages will become one of the most pressing environmental issues. It is sometimes suggested that water will replace petroleum as a focus of political tension (Inoguchi *et al* 1999: 5). It is pointed out by Goven (2003) that even with the slowest estimated population growth and the smallest demand for water in South Africa, supplies will no longer be able to meet demand- by 2020 all surface water will be used and by 2040 all surface and ground water will be used if current consumption patterns are continued.

Birkeland (2002: 16) points out that investment in eco-technologies reduces reliance on external sources of for example water, oil and minerals. Thus future security is improved by decreasing reliance on corporate and international control.

7.1.5 Development practice

Van der Ryn and Cowan (1996: 106) allude to the fact that traditional community design and layout in the urban context may soon be part of a greater process of rethinking. Changing demographics, more flexible zoning, mixed use development, the clustering of houses around shared facilities and changing views on urban hydrology are described as innovations in this regard.

Some key areas for a sustainable urban strategy (as mentioned in Ecological Solutions 2003: 92) would include education (learning to work together and decision-making); access to land (security of tenure influences type of dwelling); waste; transport (reducing car dependence); and social interaction (small urban communities/ villages).

7.1.6 Layout design

The size and nature of the suburban block can be re-examined in light of alternative examples. By realising that a typical block configuration of residential properties can fulfil different roles, adjustments can be made in the design or as part of a retrofitting process. Allowance could be made for reduced enforcement of ownership boundaries (which would require common consent) which would then allow greater multi-functionality of space. Communal recreation spaces or food gardens can for example be created. Reduced lawn areas and more productive planting can make more efficient use of space.

It is mentioned that properly designed low and medium density settlements can provide more food than farms (Lindegger 2003). An example is given of a so-called “compost community” in Australia where 4 to 5 families in a suburban block have created a communal garden across property boundaries. Such an initiative requires no formal approval. This idea can be incorporated in the initial layout design of residential blocks by keeping future adaptability of space in mind.

7.1.7 Productive open spaces

The traditional function of public open spaces in urban settlements should be questioned. To what extent is multi-functionality possible and how can these spaces adjust to current needs? For example, lack of space means that shared open spaces become increasingly important and should cater for different functions and cultures. It has the potential to take on different cultural meanings (for example initiation sites in South Africa and cemeteries). It can also provide in obvious ecological functions such as detention ponds.

Cities offer many possibilities for food growing since labour, nutrients (from manufacturing and human waste) and construction materials are readily available. City farms can be created on small pockets of land that would otherwise require maintenance without being nearly as productive.

7.1.8 Pedestrian-oriented planning

Although public transport requires extensive investment, small changes can be made by improving the pedestrian-friendliness of urban areas, even if it happens piecemeal. Enhanced by mixed-use development where a variety of needs can be fulfilled within a smaller area, such efforts could bring about a reduced reliance on private vehicles and therefore lower CO² emissions. Pedestrian and non-motorised oriented developments also visually and socially improve townscapes.

7.1.9 Conclusion on the relevance of eco-villages

Swilling and Annecke (2004: 19) summarises three key lessons that were drawn from the Lynedoch Case study:

- Ecologically designed urban systems and built forms can save households money and they can reduce the operating costs of municipal infrastructures (in particular the infrastructure required to deliver water, sanitation, solid waste removal and energy).
- It is possible to develop child-centred socially mixed communities, and in particular this can best be done if municipalities impose, via zoning conditions, a requirement that all proposed property developments must provide equally for low- and middle/higher-income households.
- If spatial integration of low- and high-income households takes place, it becomes possible to create all sorts of markets that incorporate rather than exclude the urban poor - in particular housing markets that promote rather than disrupt community-building; financial markets that build relational capital and therefore reinvestment rather than suck resources out of poor areas, and food markets that increase household nutrition levels at lower costs to the end user and higher returns for the farmer.

The application of ecological principles, as expressed in eco-villages, to a conventional development is a viable endeavour. Despite higher initial costs in some cases, gains would be made in the long run. By learning from sustainable communities, changes can be made to human settlements that would ensure future sustainability.

7.2. THE IMPORTANCE OF ECO-VILLAGES

Notwithstanding the fact that there are lessons to be learned, the question remains on how important eco-village and sustainable communities really are. Jackson and Svensson (2002: 132) question the possible impact that the eco-village concept could have on the entire world, especially on the mega-cities. The general opinion seems to be that eco-villages are predominantly rural models and are therefore of marginal importance. However, the authors (2002: 132) do feel that the eco-village vision involves more than simply “establishing co-housing in the countryside and growing your own food”. It is argued that the eco-village lifestyle can in principle be established in a mega-city or a suburb as well as in the countryside.

Drawing from the literature referred to in this study, it seems that eco-villages do have the potential to provide a sustainable alternative to the current situations in urban developments where resources are being depleted at a fast pace with no real intention to replenish or maintain it. Jackson and Svensson (2002: 132) feel that the development of eco-villages will be accelerated by the increasing cost and decreasing quality in conventional developments. According to these authors a gradual realisation of the advantages of eco-villages will take place. The same tasks can be solved at much greater cost-effectiveness and more satisfactorily for all.

Swilling (2004: 17) states that it is no longer possible to design settlements in an ecological vacuum. A trans-disciplinary approach is required to integrate the necessary ecological aspects into current development practices to make it sustainable. An integration of ecological and social systems not only requires trans-disciplinary technical skills but also more developed cultural capabilities to enable more equitable democratic and non-violent social system. Swilling (2004: 19) arrives at the conclusion that it is possible for a new culture of sustainability to emerge from cities and that this process has already started. He underscores the value of eco-villages as an example of one such experiment. Although limited in scale and impact it has the potential of gaining a far wider influence sphere. Seemingly disconnected efforts to build and maintain sustainable communities are in actual effect contributing to a greater socio-economic and environmental integration movement.

Eco-villages are an embodiment of the principles and values of sustainability. As such it provides a physical expression of the rather complex and universal concepts and theories. The fact that the eco-villages are based in specific environmental and physical contexts allows these developments to take on particular characteristics of the cultural values and needs of the inhabitants. The adaptability of eco-villages makes it suitable for widely differing contexts and as such can be applied to specific communities with non-traditional needs and values. In the South African context such a model can be successfully applied especially due to the country's particular history and its effect on the spatial and social development of the communities.

Eco-villages illustrate possible courses of action for transforming notions of sustainability into direct actions on a local scale. The greatest value of eco-villages probably lies in its capacity to serve as experimental examples and models. According to Craig (2001: 4) the formation and ongoing operation of eco-villages provides two important lessons for the wider framework of sustainability. Firstly it is described as an 'ongoing experiment in sustainable communal living' where solutions can be tried on a smaller scale before being applied to

other contexts. Secondly Craig (2001: 5) states that eco-villages can be evolutionary in their practices as understanding of sustainability increases.

Craig goes on to suggest that, once internal processes have been managed, eco-villages should start to spread the understanding that they have gained to other settings, particularly urban contexts. It should be kept in mind that sustainable solutions are not necessarily easily transferable. A re-interpretation of knowledge might be necessary for new settings and situations.

Although eco-villages can be seen as isolated communities wherein only a limited number of people can share in the benefits, it can serve as positive examples for cities. There is little doubt that in order to create a sustainable future for this planet, strategies concerning cities should be prioritised. Ruben and Harris (1992) see eco-villages as an alternative to the *ad-hoc* approach of land development, which sees all land divided into uniform blocks, regardless of context. These authors believe in the greater sensitivity to the variations of land that is achieved in eco-villages.

Although eco-villages do not yet form a large part of popular thinking around spatial development, its influence is gradually expanding through the successes of some of these villages. As they are being promoted, awareness of these types of projects is steadily improving. However, something that remains a stumbling block in the process of alternative development is the absence of what Trainer calls a “culture of acceptance” (2002: 281). This is evident in the general public’s reaction whenever a non-traditional proposal (according to their perceptions) is made. This can be seen for example in the negative reactions that people initially showed towards the Lynedoch Eco-village (Winelands District Council 2000: 8). Often people are antagonistic towards changes as they are accustomed to the status quo or hold certain views on how development should take place. This will only improve as people become more aware of the necessity for change and how it can be achieved to everyone’s advantage.

Globally, positive changes can be observed. Though small in itself, the combined impact can bring about the discussed paradigm change in development that has been discussed throughout this assignment. Sustainability is gradually becoming part of the mainstream agenda and is gathering a critical mass. The rise of social movements and non-governmental action groups supporting socio-environmental causes assists in this shift. Local initiatives and projects create influence spheres which has the ability to combine into larger actions. These, when performed in co-ordination with global and national policies, have the potential to bring about necessary change. The adoption of Agenda 21 principles, the fast-growing

organic farming sector, the gradual decline of CO₂-emissions and the slowing down of the population rate are all 'signs of hope'.

As in the negative case of individual actions causing a collective effect, the same holds true for positive actions. Small projects can serve as initiators for change and the effect can be quite substantial through a gradual build-up of awareness. The shifting of roles and responsibilities as people become individually responsible for their actions together with interaction with others can bring about efficient solutions in managing complicated and variable situations. Local responsiveness and adaptability is important and crucial in the reduction of poverty and the improvement of environments. Tilbury *et al* (2002: 6) states that sustainable community development is a process of local empowerment that allow people greater control over their own lives and the conditions under which they live.

Not everyone shares the view that eco-villages are an ideal solution for the urban future. Clugston (in Ruben and Harris 1992: 1) is of the view that eco-villages are not the critical thing to transform society to sustainability, but agree that they may be important "laboratories for the finer points to get worked out". Arkin (in Ruben and Harris 1992: 1) is also sceptical about the creation of new villages out of rural land. As a large proportion of people live in cities and suburbs, it is felt that more initiatives should also take place there.

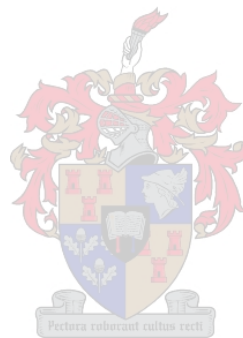
One of the main obstructions in the rapid creation of eco-villages is the drawn-out process of establishment. Although based on simple principles than can easily be applied to any context, people at ground level are often unaware of the opportunities provided by eco-villages. Initiative, capacity and leadership are therefore something that has to be present to ensure successful development. In our local context a sufficient knowledge base is lacking as many people have had little exposure to relevant theory or are simply apathetic to sustainable issues.

To overcome this, public sector should take the lead in sustainable development, with the private sector as a key partner. Local communities should be the integrating factor around which action takes place.

Inoguchi *et al* (1999: 3) sums up the value of sustainable settlements by pointing out that this commitment addresses problems which clearly exist and threaten to worsen, and creates places that are safe and pleasant places in which to work, live, and raise children, without undermining the ability of future generations to do likewise.

7.3. CONCLUSION

This study has highlighted a number of instances in which eco-villages can provide valuable lessons for urban settlements. The concept of eco-villages, despite having arguably limited influence, does have the potential to serve as an alternative urban model as it is an efficient way of dealing with urban sustainability issues. As relatively small experimental communities, eco-villages are in the position to explore and apply novel solutions, the necessity of which is evident in the global concern for sustainability. As the search for sustainable solutions to settlement problems continue, eco-villages are in a strong position to become increasingly relevant.



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Addendum A

COMMUNITY SUSTAINABILITY ASSESSMENT

This summarised assessment, based on a document compiled by the Global Ecovillage Network (2005), comprises a number of ecological, social and spiritual checklists. These categories form part of a questionnaire which, when completed, presents a calculated indication of a particular community's sustainability. The following is a simplified list of issues which provides a useful indication of concerns relevant to any community aiming towards sustainability.

ECOLOGICAL CHECKLISTS

1. Sense of place

- The number of people in the community that can be described as being connected with and living harmoniously within the place in which they live.
- The size of the community in terms of the number of people whose sole or major place of residence it is.
- The number of people in the community knowledgeable of native plants and wildlife.
- The level of active support, enhancement, protection and/or reclamation of native plant and wildlife habitat in the area, when disturbed by human activity.
- The yearly increase of humus and the extent to which this takes place.
- The state of diversity of appropriate species in the community.
- The change in quality of soil, water and air as indicators of general environmental health over the last year.
- The extent to which the natural environment of the community is disturbed by noise pollution (unpleasant sound generated by human activity and disrupting the natural quiet), light pollution (bright light sources unpleasant to neighbours and/or obscuring viewing of the stars) and litter (human trash, improperly discarded).
- The extent to which the community actively plans conservation of dwindling natural resources in consideration of the needs and enjoyment of future generations.
- The extent to which community members actively participate in environmental conservation and restoration activities (for example tree planting and non-native species removal).

2. Food availability, production and distribution

- The local availability, accessibility and affordability of sufficient food that provides adequate nutritional balance.
- The amount of food that is produced within the community, obtained from local or bioregional food producers or outside of the community.
- The extent to which surplus food is produced within the community; within the bioregion; or not at all.
- The utilisation of surplus food – stored for future use; sold; donated; used as animal feed; composted or discarded as trash?
- The utilisation of food scraps - donated; fed to animals; composted or discarded as trash?
- The extent to which greenhouse and/or roof or window gardens are used for year round food production.
- The extent to which pesticides, herbicides and chemical fertilizers are used in the community's food production.

- The type of seeds used in food production - open pollinated seeds (varieties that produce seed and preserve biodiversity, locally cultivated and exchanged) or hybrid seeds (seeds sold by commercial corporations which will not breed true and therefore cannot be saved for the following year's crops).

3. Physical infrastructure, buildings and transportation - ecological materials, methods and designs

- The local availability and affordability of sufficient housing that provides adequate shelter.
- The extent to which building materials used are natural or recyclable; recycled or reusable materials and/ or from the bioregion.
- The extent to which buildings are designed to minimize energy needs and harmonize with the natural environment.
- The extent to which use is made of the following:
 - shared spaces (for example common buildings or shared houses);
 - locally appropriate insulation standards;
 - natural/non-toxic insulation materials;
 - orientation of buildings (for light and temperature control);
 - creation of favourable outdoor microclimates (by using planting to regulate indoor temperatures);
 - design to blend with the environment (colours, materials, site selection);
 - design and construction planning for long life and/or renewability.
- The extent to which pre-existing buildings are retrofitted for sustainability or aesthetic purposes.
- The extent to which some form of “honouring of the Earth”, or attuning to it, is used to connect with the natural environment during community design, any excavating or rearrangement of the landscape, infrastructure development and community activities.
- The extent to which community design (buildings, other infrastructure, landscaping and activity areas) is done with a permaculture or other whole system approach, that respects and includes the needs of the Earth, local flora and fauna, as well as the needs of humans.
- The effective design of the community to minimise motor vehicle use inside the community (for example through clustering of buildings).
- The frequency with which community members must travel outside of the community for their needs.
- The extent to which transportation conservation methods are used – for example trail systems (walking, bike, horse); use of vehicles powered by clean, renewable energy sources; car-pooling; sharing of vehicles; mass transit availability for longer distance travel or other sustainable methods.
- The availability of opportunities to work at home versus leaving the community to work.

4. Consumption patterns and solid waste management

- The number of people in the community using any of the following methods to reduce consumption of natural resources and generation of solid wastes: voluntary simplicity (personal consumption is minimised); shared resources (equipment, tools, clothing, et cetera); shared facilities (like kitchens, storage space, offices) or bulk/ cooperative buying.
- The extent to which local marketplaces meet the community's needs.
- The extent to which the following systems are in place and used by the community: recycling; reuse; repair or making things (as opposed to buying new ones).

- The approximate number of people in the community that know the location and method of managing trash from the community (garbage removal, landfill site).

5. Water - sources, quality and use patterns

- The number of people in the community that know, respect and protect the water source.
- The nature of the water source and supply - whether it is local and plentiful/renewable; from a catchment; from a well, spring or other waterways; piped from great distance; imported (bottled); extremely inconvenient (excessively expensive, distant, scarce/rationed); or from a non-renewable source.
- The quality of the water and how it ranges between naturally clean (no treatment or filtering required); filtered to remove minor natural impurities; treated with environmental and health- friendly additives to balance the PH or mineral levels; chemically treated with chlorine, bromine, iodine or fluorine; or treated with the above chemicals, then filtered and purified.
- The nature of water storage methods and their level of sanitation.
- The extent to which the following water conservation methods are used by the community: irrigation methods that conserve water; greywater re-use; minimising household use; devices reducing the amount of water used (faucet aerators, low flow shower heads); xeriscaping (landscaping with drought tolerant native plants requiring minimal maintenance); the use of natural/ non-toxic products for cleaning, gardening and household products; and the care and maintenance of plumbing to prevent/ repair leaks.

6. Waste water and water pollution management

- The nature of sewage management systems used in the community - composting toilets, dry toilets, constructed wetlands or living machine systems; low flush toilets or standard toilets with toilet dams (objects in tank that reduce flush volume; regular flush toilets, no conservation methods; sanitation that is not adequately managed (contamination threat).
- The approximate number of people in the community that know the location and method of sewage treatment used by the community.
- The overall nature of wastewater side effects or by-products - positive (for example the growth of useful plants, aquaculture); negative (the emission of chemicals or other pollutants) or neutral.
- The quality of any water leaving the community, as compared with when it entered.
- The presence and extent of water pollution and the way it is addressed.
- The availability of local systems for the proper disposal of toxic substances and the extent to which it is made use of.

7. Energy sources and uses

- The amount of energy that is generated from renewable energy sources (solar, wind, hydro, biomass or geothermal) located at the community.
- The amount of energy that is brought in from outside the community/ bought from a utility provider that is generated from renewable sources.
- The amount of energy that is brought in from outside the community/ bought from a utility provider that is generated by nuclear or fossil fuel sources.
- The extent to which community members are aware that their energy needs are met using non-renewable energy sources.
- The availability of energy conservation information and education in the community.
- The level of energy efficiency of appliances that are used for most household needs and activities.

- The systems used for water heating and space heating or cooling: solar gain, geothermal, or, sustainable biomass (including wood) from community land; natural gas, propane, bioregional wood or biomass, or, heat pump; fuel oil, or, electricity from a non-renewable source; or other sustainable method.
- The predominant energy supply for cooking purposes - solar, or, sustainable biomass from community land; propane or natural gas; electricity from a non-renewable source; or other sustainable methods.
- The predominant energy supply for refrigeration purposes - seasonal systems or cold boxes/cellars; electricity from solar or other renewable source; propane or natural gas; electricity from a non-renewable source; or other sustainable methods.
- The consideration given to energy conservation in the construction of community buildings - building location and orientation for thermal mass, shading, et cetera by climate; the use of appropriate construction materials and methods; or the level of disregard of energy conservation.
- The extent to which energy conservation and efficiency methods are used – the consideration of energy conservation in the design of community buildings; the sharing of appliances and electronic equipment by community members; the selection of energy efficient appliances, equipment and tools; on-demand energy systems; the minimisation of household energy use; the level of care and maintenance of appliances and equipment; regular care and maintenance of buildings; natural lighting for indoor spaces; the use of compact fluorescent lighting.
- The generation of surplus energy from renewable sources within the community

SOCIAL CHECKLISTS

1. Openness, trust and safety, communal space

- The extent to which there is a basic sense of safety and trust within the community.
- The extent to which the community is a safe environment for women.
- The extent to which the community is a safe environment for children.
- The extent to which people in the community know and relate supportively with their neighbours.
- The occurrence of adult crimes in the community.
- The occurrence of juvenile crimes in the community.
- The availability of indoor spaces for communal gatherings and activities.
- The availability of outdoor spaces for communal gatherings and activities.
- The availability of places for youth gatherings and wholesome activities are.
- The frequency of social gatherings for the whole community.

2. Communication - the flow of ideas and information

- The adequacy of the community's system to provide members with opportunities to regularly share information, exchange ideas and announce needs and the extent to which community members make use of this system.
- The effectiveness of communication systems in the community for announcing social events; announcing group work activities; encouraging discussion of important community decisions; making information about past community decisions and policies available; providing opportunities to share resources, skills, transportation, et cetera; providing personal support at times when a community member is in need; or for the uncensored exchange of ideas and discussion of values and visions.
- The adequate accessibility for community members to meet and talk face to face; by phone or fax; by regular mail services or by internet or e-mail services.

3. Networking outreach and services - resource exchange (internal/external)

- The availability of information about the community to others (general public) in some form.
- The availability of programs and services in sustainable living methods, technologies and/ or businesses to community members or to the general public.
- The provision of assistance/ service by the community to those in need within the community; within bioregion; in the country; or in other parts of the world.
- The extent to which community members engage in service projects within the community; within the bioregion (surrounding or nearby community); or nationally/ internationally.
- The extent to which there are community service opportunities available for the youth.
- The extent to which the community builds relations and exchanges information, resources and support with other communities and related organizations.

4. Social sustainability - diversity and tolerance; decision-making; conflict resolution

- The extent to which community members value diversity and practice tolerance within the community.
- The extent to which the community has the power of self-governance regarding community issues.
- The use of a non-discriminatory method for important community decisions and directions.
- The transparency of decision-making and the availability of information about decision topics.
- The inclusiveness of the decision-making processes and the systems whereby it operates.
- The number of community members that regularly participate in community governance and decision-making.
- The availability of information and training in decision-making and mutual empowerment skills.
- The efficiency of the decision-making system according to community members.
- The level of success reached by the agreed-upon system in managing social difficulties and disputes.
- The accessibility of the conflict resolution system to community members.

5. Education

- The emphasis placed on education and learning in the community as demonstrated by the following: mentoring, internships and/or apprenticeship offered by those with special skills or expertise; community gatherings for information exchange and group learning; community gatherings to discuss and learn from issues and mistakes and make changes to improve what is not working well; the input and contributions of community elders; the inclusion of children in work and community activities of all kinds; parental involvement in children's educational process.
- The availability of educational opportunities (appropriate to the community) and its accessibility within the community or bioregion, including: early education (pre-school learning activities); basic education; vocational/ livelihood skills training; formal/ higher education; special interest workshops/ seminars/ group programs; wholesome programs/ activities for youth, outside of school; life experience learning opportunities.
- The availability of education opportunities to all age groups in the community or in the bioregion.

- The extent to which educational systems and teaching methods honour and support individual differences of learners (talents, aptitudes, interests & limits).

6. Health Care

- The availability, accessibility and affordability of basic health care.
- The range of health care options available within or near the community - basic health care; pre-natal care; dental care; paediatric care; emergency care; care and support for the handicapped/ disabled; maternity care; traditional healing; elder care; traditional remedies; care and support for the dying; preventive care/ teaching (diet, exercise); homeopathy; alternative practices (e.g. meditation, yoga); alternative/ eclectic therapies.
- The extent to which physical, mental, emotional and spiritual health needs are met within or near the community.
- The occurrence of deaths from preventable causes in the community.
- The occurrence of deaths from suicide, homicide or drug abuse in the community.
- The incidence of serious communicable diseases in the community.
- The extent to which there is a general commitment to healthy living in the community.

7. Sustainable Economics - healthy local economy

- The encouragement of businesses created by community members that enhance the local economy and which do not generate pollution, exploit human resources or exploit natural resources.
- The support of sustainability projects by local banks.
- The approximate number of youths that leave the community for a livelihood.
- The extent to which community members experience unemployment or lack of work for which they receive funds or other exchange.
- The approximate number of community members that have difficulty providing for their basic needs (food, shelter, clothing).
- The availability of a system dealing with economic inequalities among community members.
- The type of economic systems active in the community: self-sufficiency for basic needs; ecologically friendly cottage industry; sustainable small businesses; barter and exchange systems; education/ programmes; telecommunications or other work at home; volunteerism - work contribution; local market days; fund raising for modelling sustainable practices; voluntary levies within the community for sustainability project development; exchange with other eco-villages and sustainable communities; fund raising for community operations; or leaving the community for paid work.
- The active engagement of community members in economic cooperation in their bioregion; in their country; or with other parts of the world.
- The number of community members that would describe their work as meaningful and fulfilling.
- The approximate number of community members that would say they experience non-monetary abundance or prosperity in their life.

SPIRITUAL CHECKLISTS

1. Cultural sustainability

- The way that common cultural/ ethnic heritage is celebrated and preserved – either by oral transmission or storytelling; written records and archives; person(s) serving as historian(s); training/apprenticeship in expertise specific to the community (artisanry,

indigenous language, folk products); a shared vision/ method for ensuring continuity of the culture in the future; ceremonies and celebrations; or art.

The extent to which fellow community members that do not share a common heritage join celebrating and preserving culture and history.

- The offering of cultural programs, festivals and celebrations, open to anyone within the community; within bioregion; or not at all.
- The number of community members that are familiar with the community's history.
- The acknowledgement of the cycles and transitions of life and the sharing of celebrations, ceremonies and rites of passage.

5. Arts and Leisure

- The availability of opportunities for community members to develop artistic talents (classes, apprenticeships, and support for individual artistic pursuits).
- The extent to which the community values and encourages the development of local entertainers and entertainment.
- The extent to which community members have time for recreational and leisure activities.
- The availability of indoor or outdoor group space for art activities and events.
- The frequency of artistic events/ celebrations in the community.
- The design and appearance of the community demonstrates that the community values art, beauty and aesthetic quality.
- The extent to which the expression and experience of beauty (in art, ceremonies, poetry, gardens, architecture, et cetera) is a natural part of the community's way of life.

3. Spiritual Sustainability - rituals and celebrations; support for inner development and spiritual practices

- The freedom of community members to worship the creator/ creation, and celebrate their connection with the divine, through devotional practices of their choice.
- The availability of opportunities for contemplation and development of the inner self in the community through individual pursuit; through group programs and activities; or not at all.
- The topic and experiences of spirituality within the community are best described as: comfortable, harmonious and contributing to the overall well-being of the community or as a source of interpersonal difficulties and unrest or problems within the community?
- The conduct of group spiritual practices within the community.
- The frequency with which community members come together for spiritual practices that connect them to a deeper level of consciousness within themselves and/or to the Earth.
- The extent to which community members wishing to devote themselves to a life of spiritual mastery and selfless service, are encouraged/supported by the community in doing this.
- The extent to which the wisdom and spiritual expertise of older community members is seen as a community resource and used as a guide in community matters.
- The availability of spaces within the community dedicated for spiritual gatherings and practices.
- The approximate number of people that appreciate that spirituality manifests in many ways, and respect the ways of others.

4. Community Glue

- The opinion of community members of the quality of life in the community.

- The extent to which sharing occurs among community members about beliefs, values and experiences.
- The extent to which moral principles (such as respect for oneself and others, responsibility for personal mastery and personal integrity) are part of the community's philosophy and activities.
- The extent to which a common vision or purpose aligns and unites the community.
- The level of harmony, caring and support that exists between the various individuals and groups in the community.
- The appropriateness of sexual relationships within the community and its contribution to the overall well-being of the community or as a source of social difficulties and unrest or problems within the community.
- The endeavours of the community to strengthen its internal bonds

5. Community Resilience

- The extent to which the community is able to respond beneficially to community members in crisis.
- The ability of the community to discern when external expertise is needed to help community members in crisis.
- The frequency with which the community is able to help members facing personal or existential problems, transform the crisis into an opportunity for inner growth and self-realization.
- The extent to which the community is able to respond supportively to marginalized community members (the poor, ill, dying, troubled, disabled, elderly).
- The efforts of the community to strengthen its ability to successfully handle challenges or crises.

6. A circulatory worldview

- The extent to which the community values conscious living (personal responsibility, personal growth and caring interaction with others).
- The extent to which diversity (human) is valued and encouraged as important to the overall health and success of the community.
- The extent to which there is a shared sense of the community's place in and contribution to the world.
- The extent to which the concept of sustainability is gaining acceptance and use in the Community.
- The extent to which there is a shared commitment within the community to a greater purpose.

6. Peace and Global Consciousness

- The extent to which there is harmony within the diversity, that is, the dynamic tension of people's differences is put to creative use that benefits the community.
- The frequency with which the community engages in activities that open the hearts and minds of community members to an experience of being part of a greater whole.
- The extent to which community members are aware of and take responsibility for the effects of projecting their emotional and/or mental energy into the collective energy-field of the community:
- The frequency with which community members offer selfless service within the community or outside the community.
- The value the community places on cultivating inner peace.

Addendum B

Actions for promoting ecologically sustainable cities (Adapted from Gasson 2002: 15)

Metabolic sectors	Metabolic inputs			Metabolic outputs		
	Water saving	Energy saving	Materials saving	Solid waste recycling	Waste recycling	Gaseous waste and re-use
Scales & elements						
Dwelling unit	<ul style="list-style-type: none"> - Water saving fittings - Rain-water gathering - Sullage re-use - Smaller gardens - Graduated tariffs 	<ul style="list-style-type: none"> - Natural lighting - Solar collectors - Insulation - High capacitative building materials 	<ul style="list-style-type: none"> - Attached dwellings 	<ul style="list-style-type: none"> - Waste sorting - Composting 	<ul style="list-style-type: none"> - Sullage re-use on garden/ in toilet 	
Block	<ul style="list-style-type: none"> - Water saving fittings - Solar collectors - Insulation - High capacitative building materials 	<ul style="list-style-type: none"> - Natural lighting - Solar collectors - Insulation - High capacitative building materials 	<ul style="list-style-type: none"> - Attached dwellings 	<ul style="list-style-type: none"> - Waste sorting - Composting 	<ul style="list-style-type: none"> - Sullage re-use on garden/ in toilet 	
Local area	<ul style="list-style-type: none"> - Water saving fittings - Reduced open space standards 	<ul style="list-style-type: none"> - Local solar and wind collection 		<ul style="list-style-type: none"> - Local waste collection centre/ recycling plant 	<ul style="list-style-type: none"> - Local waste water treatment 	
Town/ city	<ul style="list-style-type: none"> - Green facilities sited in low-lying wet areas - Reduced open space standards 	<ul style="list-style-type: none"> - Mixed energy systems 	<ul style="list-style-type: none"> - Compact city form 	<ul style="list-style-type: none"> - Centralised waste collection centre/ recycling plant 	<ul style="list-style-type: none"> - Centralised waste water treatment - Sewage sludge into fertilizer - Fish farms 	
Industry	<ul style="list-style-type: none"> - Water saving technologies - Inter-plant flows 	<ul style="list-style-type: none"> - Natural lighting - Energy cascades - Co-generation and inter-plant flows 		<ul style="list-style-type: none"> - Inter & intra-industry re-use and recycling 	<ul style="list-style-type: none"> - Integrated waste water treatment works - Fish farms 	<ul style="list-style-type: none"> - Filters, scrubbers - Combined heat and power
Cross-cutting networks						
Transport		<ul style="list-style-type: none"> - Pedestrian ways - Cycle ways - Public transport 		<ul style="list-style-type: none"> - Collection costs Reduced by short distances in compact city form 		<ul style="list-style-type: none"> - non-motorised and public transport to reduce vehicular emissions
Green	<ul style="list-style-type: none"> - Green systems sited In low-lying wet areas - Indigenous plants 			<ul style="list-style-type: none"> - Compost used in urban agriculture and green spaces 	<ul style="list-style-type: none"> - Effluent & composted sludge to agriculture and green spaces 	<ul style="list-style-type: none"> - Urban greening - CO² absorption