CREATING SUSTAINABLE COMMUNITIES

by

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ABSTRACT

The objective of this thesis is to explore the procedural and substantive changes that are required to create communities that are sustainable in ecological and social terms, both on a global and local level.

Current environmental problems such as global warming, ozone depletion, acid rain and deforestation indicate that human activity is changing the biosphere at an unprecedented rate. While the western world celebrates the apparent triumph of the capitalist industrial free market system, the by-products of industrialization, including the deteriorating health of the biosphere and the increasing demands of developing nations, appear to pose serious threats to the long term sustainability of biological communities including human communities.

A community is defined geographically by its physical structure, socially by its shared values, and politically by its capacity for self-determination. Creating a sustainable community requires that fundamental change occurs physically, to minimize a community's impact on ecological systems; socially, to establish a consensus on ecological and social values for the community; and, politically, to improve the capability of communities to implement appropriate locally-based solutions to environmental and social problems.

The fact that western society has allowed life-threatening global environmental and social problems to emerge indicates that there may be a serious flaw in the way the dominant society perceives reality and humanity's place in the world. Consequently, this thesis begins with an analysis of the flaws in the dominant world view and the potential for an emerging ecological world view to form the basis for defining a sustainable

community and establishing principles for ecological and social sustainability to guide community development.

A sustainable community is defined as a community that is responsible, caring, empowered, healthy, and most importantly, in balance with nature. While there are numerous approaches to creating sustainable communities, the choices that a community should make are clearer if the community has a set of values or principles to define the goals they are trying to achieve. The principles for ecological sustainability presented in this thesis are based on current ecological theories and reflect the need for communities to preserve biological diversity, maintain the productive capacity of ecosystems, integrate human activity with nutrient cycles, minimize resource and energy consumption, and establish a dynamic equilibrium between human and natural systems. The principles for social sustainability are based on current literature and emphasize the need for communities to change societal values, meet basic needs, achieve equity, promote self-determination, and create a sustainable economy.

This thesis proposes that creating a sustainable community involves both designing procedural mechanisms to support social transformation, and implementing substantive changes to ensure the long-term sustainability of the community. A process for change must include mechanisms to build community consensus on the need and direction of change, and to co-ordinate actions both within the community and with other levels of government. Specific examples of necessary substantive changes are provided based on the application of the principles for ecological and social sustainability to many aspects of community activity including land use planning, economic development, waste management, resource use, and transportation. A short examination of various models of sustainable community initiatives are provided to illustrate a variety of experiments in

new institutions, processes and policy proposals currently being undertaken in North America that can be drawn upon by communities trying to implement local solutions to environmental and social problems.

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CHAPTER I - INTRODUCTION

As we enter the last decade of this millenium, we are faced with unprecedented global environmental and social problems. Global warming, ozone depletion, and poverty are indicative of emerging complex, interrelated environmental and social problems that threaten life on the planet. We must wonder whether the problems have always been this complex. Perhaps it was only our world view that prevented us from correctly perceiving reality. If this is the case, our continuing emphasis on incremental changes and technological fixes to resolve our problems only provides us with a false sense of security that "everything is under control" and prevents us from making the kind of fundamental changes that are necessary.

We are beginning to recognize that the underlying causes of environmental and social problems may be a result of building our society on an inappropriate world view (Berry 1989, Berman 1988, Wachtel 1983) that promotes ultimately destructive human tendencies: the domination of nature and less fortunate members of humanity, materialism, excessive individualism, and competition. The by-products of industrialization, including the deteriorating health of the biosphere and the increasing demands of developing world indicate that our survival may depend on our ability to change these tendencies and to develop new values that correspond with our changing perception of the world and our place in it. Human values are reflected in our communities, economies, laws, and political structures. A change in human values will therefore impact all these areas.

THE ORIENTATION OF THE CREATIVE

> When you shift to the orientation of the creative you firmly place the
> authority for the quality and direction of your life where it belongs: in your
> own hands. You establish a new bond between you as creator and reality
> as your field of creation. The result is a reuniting with the power of the
> individual and a renewal of the human spirit...In the creative orientation,
> when you answer the question, 'What do I want to create?' it is not clear
> whether what you want is possible. (Fritz, 1970. The Path of Least
> Resistance, p.46-51)

The objective of this thesis is to explore ways of creating sustainable communities
through mechanisms to promote changes in individual values, a shift in our world view,
and ultimately structural changes in society to reflect our greater understanding of
ecological laws. Specifically, I will examine the procedural and substantive changes that
are required to create communities that are sustainable in ecological and social terms, both
on a global and local level. This thesis proposes that creating a sustainable community
requires that change occurs physically, to minimize the community's impact on ecological
systems; socially, to establish a consensus on ecological and social values for the
community; and, politically, to improve the capability of communities to implement
appropriate locally-based solutions to environmental and social problems. As society is
entering new and unknown waters, the approach we must take is to envision or anticipate
a more secure future and develop means to create it.

Only by stepping outside the dominant world view or paradigm will we begin to see
opportunities for change that would otherwise seem impossible or irrational. Since this
thesis is an attempt to explore avenues for fundamental social change at the individual and
community level, it would be counter-productive if I attempted use a standard analytical
framework. Consequently, I do not provide an hypothesis to support or disprove. Instead I

develop a theoretical basis for envisioning and actualizing a future radically different from current perceptions of reality in the Western world.

My thesis begins with an analysis of both the dominant reductionist world view and an emerging ecological world view in order to identify the weaknesses of the current world view, and to assess the potential for the emerging world view to form the basis for defining a sustainable community. I examine current ecological and social theory to provide additional support for a set of principles for sustainability which are used as guidelines for creating sustainable communities. I explore current theories on social transformation to determine the essential components to support an ideal process of change at the community level. To validate this approach, I evaluate several examples of sustainable community initiatives against both the substantive principles for sustainablility and the essential components for a process of change. Additional examples of initiatives described in Appendix I are provided as a resource for communities wishing to build on existing models and to identify potential areas for future research. Finally, by drawing on both the theoretical basis and practical examples of sustainable community initiatives, I describe the procedural components of a model for community transformation, and identify some of the substantive changes needed to apply the principles of sustainability to community development.

I hope this thesis will prove useful to planners who believe structural change in our society is required to deal effectively with the interrelated problems of environmental degradation and social equity. It will illustrate how planners must look critically at social and economic systems and our attitudes that perpetuate these problems. Practical examples will aid planners in helping a community determine what actions it could take.

COMMUNITY AS FOCUS OF CHANGE

> In and through community lies the salvation of the world. (Scott Peck. 1987. The Different Drum: Community Making and Peace)

Communities are a focal point for change since they are microcosms of the world. Communities that are out of balance with the natural environment contribute to global environmental degradation. Our challenge must be to create sustainable communities that reflect the values of a human species capable of living in harmony with itself, other non-human species and the natural environment.

Defining Community

Community is a multifaceted concept. The term can be used to describe physical, spiritual, emotional, economic or political aspects of human and non-human interaction. Community is most commonly used to describe the physical characteristics and functions of a human settlement within a geographically defined area. The terms city and urban region are also used to distinguish settlements that are larger in size which can be made up of many smaller, interrelated communities. In ecological terms, a community includes all the plant and animal (including human) populations living and interacting within a region or ecosystem (Miller and Armstrong 1982). Members of a community are both autonomous individuals and, because of their physical relationship with other individuals or organisms, they are also functioning units of the community (Devall 1988).

Community can also refer to the emotional bond which forms among individuals united in common purpose or in response to a personal or spiritual crisis. It can be a network or social support system for people who share similar life experiences, concerns and interests. According to Peck (1987) community requires the inclusion of all members,

a commitment and willingness to coexist, and an appreciation of differences which is often reflected in the use of consensus as the dominant form of decision making.

Community, in a political sense, can refer to a local or territorial level of government. Friedman (1987) describes political community in terms of sovereignty or the ability to make collective decisions. He also describes it as a form of collective self-reliance. A political community is characterized by a defined sovereign territory, historical continuity, citizenship that carries rights and responsibilities and membership in a collection of communities (such as a nation) which share citizenship.

Transforming Human Settlements

Creating sustainable communities will require a physical transformation of settlements. Urbanization has been a significant force in development since the dawn of the industrial era. It is possible that cities may even be the deciding factor in the course of development of modern society (Bookchin 1986, Jacobs 1985). Current estimates (WCED 1987, Worldwatch Institute 1987) indicate that more than half of the world's population will reside in urban areas shortly after the turn of the century. Not only will there be more and larger cities, the impact of those cities on the surrounding environment will be increasing.

Cities create tremendous demands on outside resources (food, energy, water) and are generally inefficient users of those resources. In ecological terms cities are extremely entropic (Rifkin 1989). The availability of fossil fuels both supports urbanization and influences the way in which cities develop. Massive infusions of energy (primarily derived from coal, oil, and nuclear sources), food, and raw materials transported from surrounding regions, support increasing concentrations of human population and economic activity.

The gasoline powered automobile permits the rapid urban growth or sprawl characteristic of most North American cities. Fossil fuels, in the form of artificial fertilizers, act as a subsidy (although temporary) to agricultural production, resulting in higher crop yields (Brown 1989), decreasing the need to preserve farmland, and effectively removing any reason to control urban sprawl. Clearly, the development decisions communities make have a significant impact on global environmental problems such as global warming and acid rain. As the ecological consequences of continued fossil fuel use mount, fundamental changes in city structure will be inevitable.

Population control on a global level will be needed to slow the trend toward urbanization. However, despite some of the negative impacts of urban regions, a complete reversal of the urbanization trend is probably unwarranted. Repopulation of the rural community may be desirable in some cases but will need to be balanced against the need to preserve scarce agricultural land for food production and to protect habitat for endangered species. Alternatively, there are many opportunities for transforming human settlements into ecologically sustainable communities by integrating them with the surrounding environment and minimizing their negative impacts.

Renewing Community Values

Creating sustainable communities will require a renewal of community values that support ecological and social sustainability. According to Berry (1989), current environmental trends foreshadow not merely natural disaster on a global scale but a moral crisis for society. From this perspective, the transformation of society will require the

transformation of individual values and beliefs.1 For us to create an ecologically and socially responsible global community, we must first "learn the principles of community in our own individual lives and personal spheres of influence" (Peck. 1987:18).

Change in individual values will occur only when, convinced of the need for change, we reevaluate our goals and the lifestyle choices we make. Over time these individual values will be translated into new priorities for our society. Therefore, any attempt to develop a blueprint for a sustainable community must examine the social transformation mechanisms for creating a community built on ecological values, incorporating all people and non-human species, thriving on diversity, and operating through co-operation, caring and mutual respect.

Strengthening Political Community

Creating sustainable communities will require strengthening political community through decentralization and empowerment of individuals. The world is currently experiencing two conflicting trends: globalization and decentralization (Naisbitt 1984, Henderson 1987). Transnational institutions (including the multinational corporation, international economic zones, financial and communications networks) are becoming so large and influential that their presence threatens to make the nation state obsolete (Henderson 1987). At the same time, the difficulties in providing services effectively and efficiently from centralized bureaucracies, such as the Soviet central government, is supporting a trend toward greater decentralization of power in existing political structures. To ensure their long-term sustainability, communities need to capitalize on this trend

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1. The need for a shift in fundamental beliefs and values is examined in more detail in Chapter II.

toward political decentralization and move toward greater self-reliance by increasing their ability to provide for their own basic needs (food, health care, employment etc.) and decreasing their dependency on the global market and higher levels of government (Ekins 1990, Friedman 1987).

The community level is also an important focus for empowering individuals. Individuals tend to mobilize more effectively at the community level when they are directly impacted by change as witnessed by the urban social movements of the 1960s, and the rise of NIMBY (not in my backyard) syndrome in the 1980s. Communities are home to decision makers, artists and intellectuals, all of whom derive their energy from intense social interaction and usually become key players in shifting community attitudes. Empowered individuals have more opportunity to effect change at the community level since access to the local power structures increases the possibility that their voices are heard. At the same time, community leaders may be more responsive to grassroots pressure since they are less influenced by large institutions with vested interests in the status quo (such as oil companies) which tend to lobby higher levels of government.

The proliferation of non-governmental organizations in the developing and developed world is indicative of the increase in community based activity which is emerging as a counter-trend to globalization (Durning 1989, Ferguson 1980, WCED 1987). Non-governmental organizations operate primarily at the community level in response to failures in the existing system (e.g. failure to provide adequate environmental protection or social services) and consequently may prove to be important proponents of development that balances global and local needs.

Despite the positive impact individuals and groups are having on local environment and development policies it is unlikely that they alone will be able to shift society toward

sustainability for two main reasons. First, many groups are issue specific and have a tendency to lose sight of the need for large scale change. Second, community efforts tend to be stifled when they conflict with the vested interests of either national and transnational institutions. In an analysis of grassroots social movements in the last 400 years, Castells (1983) concluded that despite the positive change these movements achieve on a local level, on their own they are incapable of successfully creating an alternative community because they operate within the institutional structures of the dominant political and economic system that they are trying to replace. Consequently, social transformation requires that change must occur both in the institutions that define our society including government and transnational institutions, and in the individuals that support grassroots initiatives (Durning 1989).

SUMMARY

The importance of communities as a focal point for change will grow for the forseeable future as the world's population increases and places more pressure on urban regions. The challenge to create sustainable communities will be formidable. Communities will need to change physically, to create a balance between human settlements and the natural environment; socially, to establish a consensus on the ecological and social values for the community; and, politically, to improve the capacity of communities to take responsiblity for their collective destiny.

CHAPTER II - THE CONTEXT FOR SUSTAINABILITY

The underlying premise of this thesis is that a shift to a new world view is required to resolve our environmental and social problems and to create a sustainable society. As this opinion is not widely held at this time, it is necessary to examine why I believe this premise and to explore the implications of the emerging ecological world view for communities.

ORIGINS OF OUR CURRENT WORLD VIEW

Our perception of reality is filtered through cultural myths or beliefs that form the basis of our world view or paradigm. The concepts or models we use to describe reality are passed on unquestioned from generation to generation, as part of our cultural baggage, until the reality we experience differs so profoundly from our models that we are forced to reexamine those principles that we believed to be true. Such a reexamination was forced upon the Christians of the early Renaissance when Copernicus and later Galileo proved that the Earth revolved around the sun.

The recent origin of our current world view has been dealt with in depth by previous authors (Rees 1990, Berman 1988, Leiss 1972 among others). The seventeenth century ushered in an era of scientific revolution with the work of Rene Descartes, Francis Bacon and Isaac Newton. They established the basis of a new epistemology based on the belief that science was the only means of acquiring pure knowledge or "truth" about reality. Descartes divided reality into the realms of mind and matter. Bacon provided the framework for scientific experimentation with the notion that Nature would reveal its laws only under duress. In discovering the laws of mass and motion, Newton validated the

means of determining these laws through scientific method, mathematics, and the principle of methodical doubt.

The scientific method, which is a central component to the dominant reductionist world view, requires that our knowledge of Nature be gained through experimentation, by isolating parts of Nature, controlling external influences and observing the results. This reductionist approach assumes that the whole of Nature is no more than the sum of its parts. The need to separate the observer (humanity) from the the object (Nature) being studied incorrectly reinforced the view that humanity existed independent from (and superior to) the rest of life on Earth. The reductionist world view also perceives the universe as a mechanical clockwork full of reversible processes, inherent stability, and fixed laws that could be discovered through the scientific method.

This new epistemology established the widespread belief that any reality not proven through scientific reasoning has little or no value. It has also led to a world view that purposefully eliminates any religious or philosophical meaning from life. As Leiss (1972:52) observes in The Domination of Nature:

> This clear separation of natural knowledge and moral knowledge gradually became a cardinal principle of modern thought, it echoes in the fashionable contemporary distinctions between "facts" and " values", according to which questions of values constitute a unique discourse outside the scope of "scientific knowledge.

Scientific discovery and technology became the means through which humanity would assert its superior position on earth. This idea fit in well with the traditional Christian doctrine of humans having dominion over God's creation (Genesis 1:28). Although Christianity attempted to make humanity accountable to God for its dominion over creation, religion gradually lost influence as a moral force in Western culture leaving humanity unrestrained in its quest to dominate nature (Leiss 1972). The Reformation in

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the Christian church with its emphasis on personal salvation and Puritan values such as competitiveness, orderliness and self-control compounded the impact of the reductionist world view (Berman 1988). In an unlikely union, science and salvation served to unleash human arrogance and provide new values for society:

> New theological doctrines began to depart from the "eye of the needle" warnings about the incompatibility of wealth and heavenly reward and to stress that those who achieved material success were manifesting signs of having been favored by grace, of being part of the elect. Growth in the production of goods came to be the overriding goal of life and of society, as a religion of progress and success rose to challenge the prior teachings of stability and submission." (Wachtel 1983:66)

The progress of science and technology became synonymous with achieving greater mastery over nature toward creating a utopia on earth and satisfying human material wants. Eventually nature was seen to have no value except in the service of humanity. Our reductionist world view also resulted in a limited view of reality. According to Berman (1988:125), "[w]e discounted a whole landscape of inner reality because it did not fit in with the program of industrial or mercantile exploitation and the directives of organized religion."

Changing Perceptions of Reality

There is little doubt that a large portion of western society has prospered from an industrial economy based on the reductionist world view. Technological innovation and an abundant supply of fossil fuels has supported an apparently unlimited cycle of economic growth (Rees 1989, Rifkin 1989). Consequently, Western industrialized nations enjoy an unprecedented material standard of living. Despite this prosperity, environmental degradation increases, poverty in the Third World is not abated and vast amounts of resources continue to be invested in increasing humanity's destructive capabilities. The

rapid change we are experiencing in both the human and natural environment is also being felt in the world of science and economics. Consequently, our current world view is being put to the test.

Integrating Mind and Matter

Current advances in physics challenge the validity of our belief that nature is an objective reality separate from humanity that can be manipulated without consequences. Experiments dating from Neils Bohr challenge the assumption that the observer can be separated from the reality being studied (Prigogine and Stengers 1984). The evidence that an observer can have an impact on the outcome of a scientific experiment at the atomic and subatomic particle level suggests the possiblity that to some extent humanity may be an active participant in creating reality. It also reinforces the fact that humanity is an integral part of the biophysical world.

Reductionism versus Holism

The reductionist approach to science is more forcefully being undermined by our growing understanding of synergistic phenomenon in complex systems. For instance, ecological systems are characterized by numerous interrelationships and interdependencies that produce unexpected and sometimes unpredictable results when impacted. The existence of synergistic properties in systems proves that complex phenomenon cannot always be understood simply by examining parts of the whole in isolation. It also implies that the reductionist approach is appropriate primarily for understanding simple mechanical cause-effect relationships investigated by science. In contrast, an holistic

science would take an integrative approach to understanding reality as revealed in these complex interactions.

Ecological Limits

Our modern economic system is based on the reductionist world view. Economic theories characterize it as a mechanical system of unlimited production and consumption, kept in balance by the interaction of supply and demand operating as the invisible hand of the free market, and kept in motion by the individual pursuing his/her own self-interest (Rees 1990, Daly and Cobb 1989, Rifkin 1989). The reductionist world view eliminates the need to consider morality and ethics in economic decision making, such as determining the desirability of various kinds of productive activity or the necessity of providing a more equitable distribution of resources. The primary purpose of our economic activity is to satisfy all our material desires rather than to provide us with what we really need or to improve the human condition (Wachtel 1983). Our economic models assume that individuals pursuing their own self-interest will, by the magic of the invisible hand of the free market, achieve the greatest good for society. However, the invisible hand of the free market has failed to satisfy the basic needs of an increasing portion of the world's population that do not have access to capital or power.

We think of the modern economy as if it were separate from the environment. The economic engine is persistent. Its speed may alter throughout the businesss cycle but its motion is continuous. The resources to sustain the economic engine have always been considered limitless, or to the extent that a particular resource is limited there can always be found a suitable substitute. The social and environmental impacts of economic activity

have traditionally been described as externalities, costs that are outside the consideration of the individual producer to be borne by the general public.

By contrast, from an ecological perspective, the economy is, and always has been, dependent on and limited by the ecological productivity of the Earth's biosphere (Rees 1990). As a subsystem of the biosphere, it is subject to the Second Law of Thermodynamics: in any conversion of energy and matter some of the energy is always degraded to a more dispersed and less useful form, representing an increase in entropy. Indeed, "any form of economic activity dependent on material resources contributes to a constant increase in global net entropy (disorder) through the continuous dissipation of available energy and matter" (Rees 1990). The only significant process that contributes to a reduction in global entropy is photosynthesis. Green plants take dispersed chemicals, primarily water and carbon dioxide, and with the sun's energy convert them into resources to support life.

The rate of production of photosynthesis is ultimately limited by the flow of energy from the sun. Mature ecosystems, therefore, are characterized by a more or less constant rate of material and energy flow (the "steady state" system). In contrast, our economy is predicated on the assumption of continued growth. The problem is even maintaining current levels of economic activity appears to require the consumption of both the yearly production and part of the accumulated stock of biological resources. This imbalance is undermining the productive capacity of the biosphere that supports it. Declines in local fishery stocks along the coast of Eastern Canada and the death of lakes in Europe and North America from acid rain are indicative of this trend. Contrary to modern economic theory, sustaining continuous material economic growth to meet the demands of an

increasing human population who have rising expectations of material consumption would appear to be an ecological impossibility in the long-term (Rees 1990).

A NEW WORLD VIEW

The fundamental flaws of our current world view are that it contradicts our emerging understanding of ecological systems and it creates an illusory separation between humanity and the rest of the biosphere. Any new world view must correct these flaws.

A potential alternative to our reductionist world view is a new world view that recognizes the Earth as a dynamic, evolving, homeostatic system. The formulation of such an ecological world view is currently underway as illustrated in the works of Bateson (1987), Berman (1988), Berry (1989), Drengson(1983), Prigogine and Stengers (1984), Skolimowski (1978, 1990) and others. It is also reflected in many philosophies such as Deep Ecology (Naess 1988, Devall 1988), Christian Ecotheology (Wilkinson 1980, Granberg-Michaelson 1987), Ecofeminism (Plant 1987), and Social Ecology (Bookchin 1980). Skolimowski (1978) suggests that an ecological philosophy would promote concern for the well being of society, emphasize quality of life, and promote individual responsibility. It would also require people to be ecologically conscious and to make political statements through the way they live. Berman (1988) suggests that a new planetary culture must encourage co-operative interaction between the individual and the community rather than competition. Under this world view, the goal of humanity and society would be to learn to live with nature rather than to master it.

Tables I and II summarize some of the characteristics, values, social and economic implications of the emerging ecological paradigm in comparison to the dominant reductionist paradigm. The differences between these world views are significant and

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adoption of the former would result in many changes in our society. However before accepting this new ecological world view, we must determine whether it is consistent with our current understanding of ecological systems.

Drawing on the characteristics of this new ecological paradigm, I present in the following chapter a set of principles to guide the future development of a sustainable society, and in particular sustainable communities. These principles are further examined for their consistency with current ecological and social theory.

TABLE I

COMPARISON OF WORLD VIEWS

Reductionist World View	Ecological World View
Nature is known from observation	Nature revealed through active participation
Facts are scientifically proven Value has no relation to fact	Fact and value are inseparable
Requires rational, technical methodical thought	Philosophical, creative thought are equal or more important than purely rational thought
Reductionist approach assumes we can understand the whole (system, organism) by examining the individual parts	Holistic approach recognizes the whole is greater than the sum of the parts (i.e. must also understand interconnections and interdependencies)
Nature has no value except that given to it by man	Nature has intrinsic value
Earth operates as a mechanical clockwork according to known or knowable laws	Earth is a dynamic, evolving whole consisting of many interconnected and interrelated ecosystems and organisms
Processes and trends are reversible	No natural process is thermodynamically reversible
Scientific method accepts itself as the only method to determine "truth"	Many avenues to "truth". Process of discovery is self critiquing

Primary Values:

Scientific	Ecological
Rational	Spiritual
Quantity	Quality
Uniformity	Diversity
Isolation and repression	Interconnectedness and interdependence
Competition	Cooperation
Individual rights	Individual responsibility
Survival of the fittest	Emphasis on nurturing, compassion achieving balance in life, fostering respect for all living things

Sources:

Bateson. 1987. Angels Fear.
Berman. 1988. Reenchantment of the World.
Drengson. 1983. Shifting Paradigms.
Skolimowski. 1978. "Ecophilosophy versus the Scientific World View."

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TABLE II

IMPLICATIONS OF EACH WORLD VIEW

Reductionist World View	Ecological World View

Social implications:

Reductionist World View	Ecological World View
Reality is tangible, measurable. Existence of God questioned. Loss of moral values.	Recognition of existence of some form of greater unity, or cosmic consciousness. Intangible, spiritual regain importance.
Humanity believes it is the dominant species on Earth	Humanity recognizes that is only one of many interdependent species on Earth
Primary social institutions are centralized, hierarchical power structures: the nuclear family, the state and the corporation	Primary social institutions are decentralized, non-hierarchical structures: the community, networks and the extended family
Attempt to solve environmental and social problems independently of one another.	Environmental and social problems are interrelated and inter-dependent, therefore, integrated solutions must be found.
Technology is large scale, complex and used to dominate nature and control human activity	Technology is small scale, "appropriate", integrated with nature and supportive of human activity.
Health care system emphasizes disease cures through chemical and biological manipulation	Holistic health care emphasizes disease prevention, restoration of mind/body balance and natural healing
Society based on manipulation of the environment and the elimination of wilderness through cultivation	Society based on stewardship of resources and achieving a balance between wilderness and civilization
Homogenization of culture and nature is desireable	Diversity in culture and nature is encouraged

Economic implications:

Reductionist World View	Ecological World View
Goal is progress as measured in terms of economic growth to satisfy human material needs	Goal is balanced development to satisfy human, physical, productive, moral and spiritual needs and the enhancement of life for all the planetary community
Economy characterized by unbridled growth	Economy operates in a steady state
No perceived limits to human activity	Ecological limits to human activity
Reliance on technological innovation to feed economic growth	Reliance on developing human potential to create economic self reliance
Predominant economic institutions are the multinational and big government	Predominant economic institutions and are co-operatives and the community development corporation

Sources:

Berman. 1988. The Reenchantment of the World.
Drengson. 1983. Shifting Paradigms.
Rifkin. 1989. Entropy.
Skolimowski. 1978. "Ecophilosophy versus the Scientific World View"

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SUMMARY

Our emerging understanding of reality indicates that the reductionist world view is no longer adequate. Consequently, we must seriously consider whether solutions based on the prevailing mythology will have any chance of success at resolving current environmental and social problems. The emerging ecological world view may provide an alternative perspective from which we can understand the world around us. It has the potential to correct the major weaknesses of the current world view by providing an holistic approach to understanding reality, emphasizing humanity's interdependence with other species and the physical world, and requiring human activity to remain within the ecological limits of the biosphere. It also provides a reasonable basis for transforming our values. Some believe that this transformation is already in process (Ferguson 1980). The current challenge for Western society is to recognize the discrepancies between our reductionist world view and reality, and to use this opportunity to change our models and our consciousness. We need to complete a process of shifting paradigms (Drengson 1983).

CHAPTER III - DEFINING A SUSTAINABLE COMMUNITY

Many of our environmental woes are due not to deliberately destructive behaviour but to ignorance of ecological principles. The process of civilization, especially that in the Western world, involved a progressive separation between humanity and Nature. The design of modern cities is a testament to the vigour with which we have pursued this separation. One of our greatest challenges will be to re-integrate humanity with Nature both intellectually and physically in the creation of environmentally sustainable communities. This challenge requires that we have a greater understanding and respect for Nature and ecological laws.

All human activity affects the environment. Poverty, or a failure to meet basic human needs, continues to be a major cause of environmental degradation as people clear forests and overwork the land to meet their daily energy and food requirements (WCED 1987, Myers 1984). The problems of global warming and ozone depletion indicate that human activity is causing significant impacts on global biogeochemical and biophysical systems. Consequently, creating sustainable communities requires that we also examine the social, political and economic aspects of human activity that impact on sustainability.

FROM NEW WORLD VIEW TO PRINCIPLES FOR SUSTAINABILITY

Many of the components of the emerging world view, as outlined in Chapter II, are derived from our growing understanding of the properties of ecological systems. If this emerging world view is to form the basis for a new society then it is reasonable that communities should be designed according to ecological principles (See Glossary for full definition of key ecological terms).

Specific ecological components of this emerging world view (from Table I) which have direct bearing on sustainable community development include: the value of diversity; ecological limits on human activity; the fact that earth consists of many interconnected ecosystems and organisms; the thermodynamic irreversibility of natural processes; and the dynamic and evolving properties of Nature (earth). These components are examined for consistency with current ecological theory, and developed into Principles for Sustainability #1 to #5 respectively.

Specific social components of the emerging world view (from Table I and Table II) that have a direct bearing on sustainable community development include: the need for new ecological values; supporting development to meet human needs; the relationship between environmental and social problems; individual responsibility and the need for decentralized institutions; and achieving balanced development to meet the needs of the planet by creating a sustainable economy. These components are examined for consistency with current social theory, and developed into Principles for Sustainability #6 to #10 respectively.

Future research will need to be directed at analyzing the remaining (and any new) components of the emerging world view in the same manner to develop additional principles for sustainability.

ECOLOGY AS A BASIS FOR COMMUNITY DESIGN

> Ecology: the study of the complex interrelationships both among organisms and with their organic and inorganic environment.[2]

Living in harmony with nature will require that existing communities, including large urban regions, be restructured and new communities designed according to ecological principles. The natural environment is capable of absorbing many of the impacts of human activity providing essential productive capacities are not undermined. Human settlements designed to integrate with natural processes within the limits of a particular ecological region (or bioregion[3]) will provide an environment that is healthy for human and non-human residents of the community.

Using ecology as a basis for organizing human society and human settlements is a concept that is gaining recognition. In A Blueprint for Survival (Goldsmith et al 1972) the principal ecological and social conditions of a stable society (one that can be maintained indefinitely) were identified as: minimum disruption of ecological processes, maximum conservation of resources, stable population and a social system that promotes these conditions and protects individual freedom. McHarg (1969) explored ways of integrating urban design with existing environmental features such as landscape, soils and natural

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2. The term ecology is derived from the Greek words oikos (meaning house) and logos (meaning study). Eugene Odum defines the subject as "the study of the structure and function of nature." Unlike biology, the other life science, ecology takes a broad or holistic view of life processes and the interractions of organisms with their environment.

3. Bioregion is a term that combines the concepts of life (bio) and territory (region). It is an area determined by specific ecological features (such as a watershed). Bioregionalism is a social movement that promotes stewardship of the land, celebrates human connections with the local environment (land, plants, animals, water, air), and encourages regional identity (history, community aspirations). See Glossary for further explanation.

processes. Todd and Todd (1984) developed precepts that emphasize using the living world (organisms, ecosystems, bioregions), natural processes (succession, evolution) and biological equity (the just access to a distribution of basic resources) as examples of appropriate design. Robinson et al (1990) proposed a set of values and principles to promote sustainability which they define as "the persistence over an apparently indefinite future of certain necessary and desired characteristics of the socio-political system and its natural environment". Mayur (1990) described a "green city" as one that is in harmony with natural processes, is self-sustaining, healthy and supports biological diversity. These sources support the idea that a community must be sustainable from both a cultural and ecological perspective.

The following principles are proposed as a preliminary basis for defining a sustainable community. Ecological principles for sustainability are examined for their consistency with current ecological theory as found in Ricklefs (1983), Miller and Armstrong (1982), Smith (1986) and other sources as noted. Principles for social sustainability are examined in relation to recent literature on this issue.

Principles for Ecological Sustainability

Preserving Biological Diversity

Principle #1 : A sustainable community recognizes that all life forms are connected through natural processes and that each component plays a part in preserving the integrity of the overall ecosystem. Therefore the community strives to preserve the biological diversity of the bioregion.

Implications of Principle #1:

-Communities should avoid creating unnatural ecosystems in green spaces (city parks, greenbelts, backyards) which require intensive human management. This includes monocultures and the introduction of non-native species.

-Communities should preserve and restore natural ecosystems, reintroducing wildlife where possible.

-Communities should avoid management techniques that reduce biological diversity. For instance, natural predators should be reintroduced to control pest populations as opposed to using chemical pesticides.

Diversity in biological and social terms is a value promoted by the ecological world view. The study of ecology is an attempt to describe and understand the complexity and diversity of living systems. Although all organisms are to some degree independent, autonomous individuals, they are also interdependent with other life forms. They are connected by the transfer of nutrients and energy through food webs, nutrient and biogeochemical cycles. These relationships are usually most intense within a given ecosystem.4 Each organism fills a particular niche within an ecosystem. It has its own strategy for survival and it also has a function as a member of the communtiy. As a consumer, it may be essential to the process of nutrient conversion for other species. As a predator, it may play an essential role in keeping the population of other species within the carrying capacity of the region. Consequently, removing one species from the ecosystem may lead to unexpected impacts in other parts of the system. There is also some evidence

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4. An ecosystem is a relatively self-contained ecological community which includes the biological organisms (biotic) and the physical factors (abiotic) such as climate and terrain that form the environment. The boundaries between ecosystems are not always easily identified; however, a zone of transition where the mix of species changes (dominant species disappear and new species are introduced) generally indicates a shift between two distinct ecosystems. The planet or biosphere consists of the world's many overlapping aquatic (e.g. lakes, swamps, rivers) and terrestrial (e.g. forests, grasslands, tundra) ecosystems.

that biological diversity contributes to the stability and maintaining the structures of an ecosystem (Miller and Armstrong 1982).

Although all human activity disturbs natural communities to some degree, we have had a tendency to purposely simplify the ecosystems we interact with. Whether it is creating a monoculture (single species crop) in agriculture and forestry, or replacing natural vegetation with grass in city parks and backyards, the reduction in biological diversity puts the entire ecosystem in a disturbed state and individual organisms in an environment from which they have not evolved. The price we pay for "exploiting natural resources [in this way] is the price of maintaining their stabilty by constant management: curbing pest infestations, maintaining soil fertility, and cleaning out weeds." (Ricklefs 1983:445)

Maintaining the Productive Capacity of Ecosystems

> Principle #2: A sustainable community lives within the ecological carrying capacity of the bioregion by ensuring that it does not consume more than local ecosystems are capable of producing within a reasonable management cycle. This will ensure that the productive capacity (the flow of energy and materials) of local ecosystems is maintained.
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> Implications of Principle #2:
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> -Communities should limit their size. The limit will vary depending on the technology available to control the pollution produced by the community and the per capita rate of resource consumption in the community.
>
> -Communities must not overload the natural recycling capacity of the environment.
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> -Development in a community must not undermine the essential biological processes of photosynthesis and energy conversion through the food chain. This implies that complete ecosystems (e.g. forests, wetlands) must be preserved in and around the community.

-Development must be restricted from areas that are highly productive from an ecological perspective (e.g. wetlands, estuaries, rain forests).

The emerging ecological world view recognizes that the ecological limits on human activity are determined by the productive capacity of the biophysical environment. The global ecological limits of human activity were discussed in Chapter II. The regional limits to human activity can be determined in terms of carrying capacity.

The carrying capacity of a species is "the maximum population that can be supported indefinitely in a given habitat without permanently damaging the ecosystem" (Rees 1990). Populations are regulated by the balance between the opposing forces of the inherent growth potential of the population and the limits to population growth imposed by the environment, such as the supply of non-renewable and renewable resources, predation and competition (Ricklefs 1983). When a population exceeds its carrying capacity it depletes the resources of its habitat and starvation, disease or structural change in the ecosystem causes the population to decline.

The carrying capacity for communities is dependent on the per capita rate of resource consumption, including the consumption of the regional ecosystem's natural waste recycling capabilities (Rees 1990), and the technology available to minimize the impact of resource use. The free movement of ecological resources through inter-community trade makes it difficult to determine a regional human carrying capacity as it allows an excessive population in one community to be subsidized by the biological productive capacity of another region (Rees 1990).

Within a bioregion, there are some ecosystems (such as estuaries and wetlands) that are more biologically productive than others. Unfortunately, cities have been located in or near these ecosystems for transportation purposes, resulting in the loss (or damage) of much of this valuable habitat. As noted in Chapter II, the process of photosynthesis

makes plants the only organisms that are truly biologically productive. Ironically, human settlements, especially the modern city, virtually eliminate native vegetation and replace it with man-made structures and a few ornamental (generally non-native) plant species on which few other species can survive.

Integrating Urban Functions with Nutrient Cycles

> Principle #3   A sustainable community recognizes the essential role of the flow of nutrients to the integrity of ecosystems and ensures that the quantity and content of nutrients transferred between bioregions is balanced.

> Implications of Principle #3:

> -Communities should ensure that the natural cycle of nutrients is not broken. For instance, to the extent that food has been imported from surrounding regions, organic wastes (including sewage) must be returned to the land to maintain the soil's fertility and to improve water quality.

> -Communities should ensure that the components essential to nutrient recycling are protected (e.g. vegetation, soil microorganisms).

> -Communities should minimize the use of natural or biodegradable chemicals to an amount which can be recycled without undermining the productive capacity of local and global ecosystems.

> -Communities should avoid the production and use of artificial chemicals especially those that are persistent (have long half-lives) or are not biodegradable.

> -Communities should measure the flow of energy and material through the bioregion and ensure that the community is not "living beyond its ecological means".

The emerging ecological world view sees the Earth as a whole consisting of many interconnected ecosystems and organisms. It emphasizes the need to consider these interconnections and interdependencies in order to understand the whole. According to ecological theory, the biotic and abiotic components of an ecosystem are linked by a

constant flow of nutrients and chemical energy ultimately derived from the sun. The system is further defined by the specializations of the living organisms as primary producers (autotrophs) or consumers (heterotrophs). Plants (primary producers) are the base for the entire energetic or trophic structure of the ecosystem. Through the process of photosynthesis they are capable of using the sun's energy to convert raw materials (carbon dioxide, water and nutrients) into usable "food" or chemical energy. Through the food chain, all other living organisms derive their sustenance from the work of plants either as primary (plant eaters) or secondary (organisms that feed on plant eaters) consumers. At each link in the food chain the organisms dissipate most of the food energy they obtain in heat and motion. As a result, with each successive link in the trophic structure, the amount of usable energy available to the next level of organisms is lower.

Nutrient cycles are affected not only by human activities which alter the composition of a specific nutrient in the atmosphere, soil or water but also by the introduction of man-made chemicals which can inhibit natural processes essential to maintaining the integrity of an ecosystem. For instance acid rain, which is the result of industrial and automobile emissions (including sulphur dioxide and nitrogen oxides) into the atmosphere, destroys organisms involved in the recycling of nutrients in aquatic ecosystems.

Occasionally the nutrient cycles within an ecosystem can become unbalanced through natural processes (e.g. the accumulation of dead organic material in lake sediments resulting in the formation of coal or peat) or human processes (e.g. the accumulation of carbon dioxide in the atmosphere primarily from the combustion of fossil fuels). However, most ecosystems exist in a steady state in which the nutrients flowing

out of the system are balanced with those nutrients flowing in from other systems, including the atmosphere and the earth's crust (Ricklefs 1983).

Communities must identify and monitor the key nutrients cycling through local ecosystems. Efforts must be made to ensure that nutrients follow their natural cycles and are returned to the appropriate ecosystem (such as returning organic material to food producing areas rather than disposing of sewage in nearby aquatic systems). Community activities should be designed to minimize the disruptions to nutrient cycles and must ensure that the transfer of nutrients between systems is balanced.

Minimizing Energy and Resource Consumption

> Principle #4: A sustainable community minimizes the flow of energy and material resources through the bioregion.

> Implications of Principle #4:

> -Communities should minimize their need for energy, especially energy from outside sources. This could be achieved not only through energy efficiency measures but also through eliminating some uses of energy and developing alternative sources of energy at the local level.

> -Communities should promote voluntary reduction in material consumption. When new materials must be used, provision for their reuse and recycling should be in place before any waste is created.

> -Where possible, preference should be given to local sources of materials and food. Unnecessary transportation of goods is a highly inefficient and non-productive use of energy.

The emerging ecological world view recognizes that natural processes are not reversible in thermodynamic terms. According to the First and Second Laws of Thermodynamics[5] energy flowing through an ecosystem is not created or destroyed,

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5. First Law of Thermodynamics: energy is neither created nor destroyed in any ordinary physical or chemical process, but merely changed from one form to another.

although some energy is always dissipated into lower and less useful forms of energy within the ecosystem. The second law also states that in a closed system the level of entropy tends toward a maximum. Except for the flow of energy from the Sun, the Earth is a closed system. Thus photosynthesis is the only truly productive process in the Earth's biosphere in that it generates negative entropy. All other activity, including human activity, although appearing to be productive, is only able to take the energy provided by the work of green plants, transform it into new organisms or economic goods, and produce byproducts such as heat and pollution which adds to the entropy of the system.

Given that most of the world's resources are finite, and potentially renewable resources are limited by their ability to capture and convert the Sun's energy, human activities and the communties we build must attempt to minimize resource consumption and the disorder or entropy we produce from that consumption. According to Rifkin (1989), this requires that human development must move from its colonizing stage which maximizes energy flow through by feeding off energy in the surrounding systems, to a climactic stage of development - minimizing energy flow through. Although this transition will not occur overnight, communities could minimize their energy and resource consumption by increasing energy efficiency, promoting mass transportation use and requiring waste recycling.

Second Law of Thermodynamics: the conversion of energy always involves a loss of some energy to degraded or less useful forms (such as heat and motion). The tendency toward disorder in a system due to energy degradation is known as entropy.

Achieving Dynamic Equilibrium between Human and Natural Systems

> Principle #5a: A sustainable community should be designed as a homeostatic system and be flexible to adjust to short-term fluctuations and long-term shifts in changing ecological systems.

> Implications of Principle #5a:

> -Communities should incorporate negative feed back mechanisms into their development strategies (e.g. as pollution increases, the community should limit pollution creating activities to protect the health of the community and the environment).

> -Communities should be conscious of their coevolution with the natural environment. The relationships between the human and natural environment demand that each system respond to changes in the other system.

> -Communities should discourage development in critical global ecosystems.

> -Communities must understand the systemic nature of change in ecological systems, anticipate new opportunities and threats to ecological health, and adjust planning and development options in response to these trends.

> -Communities must be prepared to act in the face of uncertainty with the understanding that some ecological changes are irreversible.

> -Communities must design institutions that are flexible and responsive to change.

Homeostasis is a process of self-regulation occurring in complex systems which allows the internal conditions of the system to remain stable in the face of a varying external environment (Ricklefs 1983). The human body is an example of a homeostatic system that manages to maintain a constant internal temperature despite wide variations in the external environmental conditions to which it is exposed. The system controls itself through negative feedback mechanisms which act like a thermostat. When the temperature of a room becomes too hot, the thermostat measures the change and turns the furnace off; when the temperature becomes too cold, the thermostat turns the furnace on.

When a system is changed due to external influences, negative feedback mechanisms act to restore a system to its norm or stable state.

The concept of a homeostatic system has been applied to the functioning of the entire Earth (Gaia). The Gaia hypothesis put forward by Lovelock (1979) proposes that the biosphere is a self-regulating entity with the capacity to keep the planet healthy by controlling the chemical and physical environment. According to Lovelock, "the only feasible explanation of the Earth's highly improbable atmosphere was that it was being manipulated on a day to day basis from the surface, and that the manipulator was life itself" (Lovelock 1979:2). The hypothesis suggests Gaia has a tendency to optimize conditions for all terrestrial life; and that threats to Gaia's optimizing capacity depend on whether vital systems (such as tropical rainforests) or redundant systems are being damaged.

To be in equilibrium with the surrounding environment, sustainable communities should be designed as homeostatic systems with appropriate negative feedback mechanisms. For instance, monitoring environmental indicators such as air and water quality, energy and resource flows, or developing a quality of index would provide a means for determining when development must be reduced or altered to maintain the long-term sustainability of the community. Communities must also recognize that threats to global homeostasis are also threats to local sustainability. Therefore global threats such as tropical deforestation and ozone depletion demand a response from the community level although the connection is not immediately clear.

In addition to displaying homeostatic properties, current theory indicates that ecosystems are also dynamic and evolving. Holling (1986) has described several successive myths to explain humanity's evolving perception of the behaviour of ecological

systems. Society shifts from one myth to another when nature fails to behave according to the expectations of the old myth. Our perceptions of natural ecosystems, as illustrated by these myths, affects the ways in which we choose to manage or protect those ecosystems.

The first myth is an equilibrium-centered model that assumes nature is constant. This myth, which is consistent with the dominant current world view, emphasizes global stability6. It represents a world where all impacts from human activity are reversible, consequently there is no need to restrict the size or method of our interventions. The development of industrial society (its economic activities, technologies, institutions and communities) is based on this myth that Nature is fundamentally benign. Until the industrial revolution and the human population explosion, building our society around this myth resulted only in localized damage to the environment. However, with our expanded ability to inflict large scale damage, our continued belief in this myth poses a very serious threat to the Earth's productive capacity.

A second ecological myth, which guides many of our current resource management practices, is a multi-equilibrium model in which ecological systems can exist in one or more stable states. It is the qualitative properties of important ecological processes (such as nutrient cycling) of the system that determine the existence of the stable regions and the boundaries that separate them. An ecological system could be forced from one equilibrium point to another through the accumulation of slow changes until the boundary conditions

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6. Stability is the propensity of a system to attain or retain an equilibrium condition of steady state or stable oscillation ... Resilience, on the other hand, is the ability of a system to maintain its structure and patterns of behavior in the face of disturbance ... Stability, as here defined, emphasizes equilibrium, low variability, and resistance to and absorption of change. In sharp contrast, resilience emphasizes the boundary of a stability domain and events far from equilbrium, high variability, and adaptation to change. (Holling 1988:297)

are exceeded resulting in a system overload and causing a sharp discontinous change in the system itself. The management response to this type of myth is either to 1) engineer the variables in the system to ensure that they do not go near the boundary conditions, or 2) allow the variables to exceed flexible limits providing natural and designed recovery mechanisms are adequate. This myth implies that ecological systems require constant (human) management to ensure that they stay within their region of stability.

The final myth Holling describes is one that views ecological systems as being in a continuing state of evolution. During the natural cycle of change, systems move through a process of increasing organization and stability and periods of reorganization and renewal which determine the productivity and resilience of the system. The values of the parameters that define the system are maintained by genetic, competitive and behavioural processes which shift in response to natural variability. As key values become more homogenous, the capacity of the system to absorb change is reduced and the system reorganizes. System reorganization can be brought about for beneficial reasons by self-regulation (i.e. homeostatic control). System reorganization resulting from external control (e.g. human management) can often be devastating. This view of nature implies that human institutions should be flexible to allow evolutionary changes in the environment. We should also improve our efforts to anticipate, monitor and adapt to such change. This final myth better describes the actual functioning of ecological systems as we now understand them and is consistent with the emerging world view that sees the Earth and its component systems as dynamic and evolving.

Holling's evolutionary systems myth is similar to Prigogine's theory of self-organization in non-equilibrium systems. A non-equilibrium system requires a large amount of energy taken from surrounding systems to maintain its organization. The

dissipation of energy through the system hastens a system reorganization. In non-equilibrium conditions, fluctuations within the system increase, making them suceptible to significant change as a result of random or chance events. A fluctuation may become so powerful that it shatters the entire system organization and moves the system down a new path of development or reorganization. Unfortunately, there is no guarantee that the reorganized system will be favourable to organisms that existed as part of the previous system. This theory implies that no system can remain stable; instead it must move into a period of creative destruction as a way of reorganizing energy and allowing a new order to emerge.

Although Prigogine's theory is eloquent and has many supporters, it has also attracted some skeptics. Rifkin (1989), for example, believes that:

> The theory of dissipative structures is an attempt to provide a growth paradigm for an energy environment based on renewables, just as Newtonian physics provided a growth paradigm for a nonrenewable energy environment...(it) provides a perfect rationalization for the age of bioengineering. It places a positive value on increased biological complexity and the continued reordering of living matter into new structures...With dissipative structures we move from viewing the world as an industrial machine to viewing it as an engineered organism. (Rifkin 1989:277-278).

Rifkin agrees with the basic principle that excessive fluctuations will cause a system to reorganize. However, Prigogine suggests that, providing free energy is available, each reorganization causes the system to become more complex, integrated, energy intensive, and vulnerable to continued fluctuations, but it also becomes more flexible and better able to adapt to changes. In contrast, Rifkin suggests that in the current world situation greater complexity has often led not to greater flexibility but to a narrowing of options, inflexibility, and system collapse.

The implications of self-organization and developing systems theory are reflected in the emerging ecological world view. The theories suggest that since developmental change is inevitable, we must learn to live with uncertainty and anticipate change while constantly finding ways to adapt. We must learn the dynamics of local ecosystems, identify critical variables, and recognize non-linear processes which may lead to a system reorganization and create new opportunities and new problems. We must also incoporate uncertainty into our planning processes, recognize when we can influence change, and create institutions that are flexible and responsive to change.

Regardless of whether the theories of developing or self-organizing systems aare valid, there is ample proof that ecological systems are constantly in a process of change. When a natural community is disturbed by external influence, including human interference, it is slowly rebuilt through succession, a process in which a system moves from an early successional association to a climax as one species is replaced by another over time. In some cases, such as the West Coast rainforest in British Columbia, it can take hundreds of years for a system to reach a climax state. This process of change demands that human communities be flexible and responsive to change in the natural environment.

Principle #5b: A sustainable community recognizes that the current state of our knowledge of natural systems does not allow us to predict all the potential adverse impacts of human interference in those systems.

Implications of Principle #5b:

-Communities should not only strive to reduce the impact of human activity on the environment but must continually monitor the health of the bioregion in order to identify and act quickly to minimize the impact of unexpected effects.

Human interference in natural systems, such as the introduction of man-made chemicals, can produce totally unexpected impacts throughout the ecosystem. For example DDT, a commonly used pesticide in North America until it was banned here in the 1970s, illustrates how a man-made chemical can link with natural cycles to create its own unique recycling process. At the time of the introduction of the chemical, a low level of concentration of DDT was not considered to be toxic to organisms other than the 'pests' it was meant to control. However, the process of concentration (known as bioaccumulation) caused organisms near the top of the food chain to accumulate unexpectedly high (often lethal) levels of DDT (Miller and Armstrong 1982). The bioaccumulation of DDT was unpredictable at the time because of our limited knowledge of natural systems. Similarly, the impact of chloroflurocarbons on the ozone layer was unpredictable at the time the chemical was first invented and used, due to our limited understanding of the processes at work in the Earth's atmosphere (Rees 1989).

Another aspect of uncertainty is the behaviour of ecosystems under stress from human activity. For years, some ecosystems can appear to suffer no ill effects from human intervention until they are pushed too far from their equilibrium. An example of this is the process of accelerated eutrophication in lakes and coastal waters caused by excessive levels of nutrients such as nitrates and phosphates. A slow increase in these nutrients is neutralized by a natural feedback mechanism: the recycling of nutrients by aquatic plants such as green algae. However, once the recycling capacity of green algae is exceeded an "ecological backlash" or system reorganization occurs when an explosive growth of blue-green algae (or dinoflagellate blooms which cause "red tides" in coastal areas) is experienced. This organic material eventually falls to the bottom, is eaten by oxygen consuming bacteria, leading to a serious depletion of oxygen in the water and often

resulting in large fish kills and the eventual collapse of the aquatic nutrient recycling system (Ricklefs 1983).

Sustainable communities must recognize that our ability to understand the complex workings of the natural world is limited; therefore, the full impact of human activity on the natural environment cannot always be predicted with certainty. In addition, there are not always obvious signals that an ecological system is under stress from human activity. Consequently, it is necessary for sustainable communities to monitor trends in key indicators of ecological health and adjust human activity in response to these trends.

Principles for Social Sustainability

Developing Values for Ecological and Social Sustainability

Principle #6: A sustainable community has citizens that are spiritually aware, socially responsible and feel empowered to act.

Implications of Principle #6

-Individuals need to develop the spiritual dimension of their lives.

-Individuals need to develop a lifestyle that reflect values that are ecologically and morally responsible.

-Individuals need to act within their community to bring about change that reflects these values.

The building blocks of a community are individuals. In order for a community to become sustainable in human and ecological terms, individuals must feel they are valued members of the community and in return they must act as responsible members of the community. A sustainable community requires that individuals co-operate for the greater good of the community, but it also recognizes that the individuals must be able to realize

their full human potential (Robinson et al 1990). As indicated by the ecological world view, individuals must develop new values that are ecologically sound and reflect a better balance between conflicting human characteristics (e.g. co-operative versus competitive behaviour, intuitive versus rational thinking, taking responsiblity versus demanding rights).7 Individuals must also be empowered to bring about the changes required by their community if it is to become sustainable. They must come to realize that their individual efforts (both within their homes and workplaces, and on a political level) can make a difference.

Meeting Basic Human Needs

Principle #7: A sustainable community ensures that the basic human needs of the population (energy, food, water, housing, employment, healthy environment, education) are met.

Implications of Principle #7

-Communities should take responsibility for ensuring the well-being of their citizens. This requires opportunities for people to provide for their needs. It may also require taking control of economic and social programs (or designing new programs) that have previously been left to higher levels of government.

-Communities must design policies and programs that address local problems in a more comprehensive way, recognizing the interrelationships between ecological, economic and social problems.

-Communities in developed countries should make it a priority to find ways of assisting the world's poor to meet their essential needs.

A community is sustainable in human terms when the ills of society such a poverty, disease, unemployment, violence, corruption are eradicated (or at least

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7. See F. Capra, The Turning Point and for further discussion on the imbalance or disharmony in the dual aspects of human nature in western society.

minimized). At the root of many of these problems is the failure of the community to provide for the basic needs of its members. The World Commission on Environment and Development (WCED 1987) recognized the requirement to meet human needs, especially the essential needs of the world's poor, as central to the achievement of sustainable development. They concluded that while poverty and inequity continue to exist, the world will be prone to ecological disaster. Robinson et al(1990:44) conclude that socio-political sustainability requires that:

> All persons should have freedom from extreme want and from vulnerability
> to economic coercion as well as the positive ability to participate creatively
> and self-directedly in the political and economic system.

The emerging world view emphasizes the need for development to meet basic human needs. Until people have the means to provide for themselves and no longer live in fear of each other there is little chance that they can devote their energies to ensuring the well-being of the planet. Meeting basic human needs may require that communities take responsibility for many social, economic and international development programs that have usually been determined by higher levels of government.

Achieving equity (locally and globally)

> Principle #8: A sustainable community strives to achieve social equity both
> within the community and internationally.

> Implications of Principle #8

> -Communities in the industrial world should reduce their per capita rate of
> consumption of resources and actively seek ways to share information,
> technology and resources with communties in the developing world.

> -Communities should ensure that all citizens have equal opportunity to
> provide for their needs (including food, shelter, and education).

Recognizing the relationships between disparate problems, such as social and environmental problems is a characteristic of the emerging world view. The relationship between social equity and environmental sustainability is most striking on a global level. Poverty in the Third World (resulting from overpopulation, resource exploitation by the developed world, and war) is a major contributor to the undermining of local ecosystems (such as the tropical rainforests). We are told that there are now more hungry people in the world than ever before (WCED 1987). At the same time we are aware that 26% of the world's population living in the industrialized countries consume 79-86% of the world's non-renewable resources and 34-53% of the world's food supply (WCED 1987:33). However, given the state of the global environment it is unlikely (some would say ecologically impossible) that both the developed and developing world can dramatically increase their consumption of resources to provide for the demands of the global population. Without engineering a dramatic decrease in the human population, a redistribution of wealth between the world's rich and poor countries remains as the only reasonable option for providing for the basic needs of all humanity. Sustainable communities should take measures to ensure that their demand for the world's resources is minimized, and actively participate in programs to share resource and expertise with the developing world.

Promoting Self-Determination

Principle #9: A sustainable community promotes self-determination.

Implications of Principle #9:

-Communities should ensure that all citizens have equal access to and are encouraged to actively participate in community decision making.

-Local governments should work in co-operation with community non-governmental organizations to provide for community (social, environmental, and economic) needs.

-Communities should develop unique local solutions to problems.

-Communities should develop institutions that seek to achieve both long term and short term goals, use an integrated or holistic approach to resolving problems, require extensive community involvement and promote local self-reliance and local control of resources.

Our moral responsibility to achieve social equity is not limited to providing for the less fortunate by shifting a few resources from the have to the have-not nations. Equity also requires that people are given the opportunity to provide for themselves. According to Gardner and Roseland (1989:29):

> True equity in the meeting of people's needs depends not only on the sharing of wealth but the sharing of power (an egalitarian social order). Power is best shared under conditions of peace, effective citizen participation in decision making, "human scale communities" decentralization of management and political control - in other words, conditions of social self-determination. From self-determination stems the potential for community self-reliance, cultural integrity, enhanced creative and problem-solving capabilities, and individual development and fulfillment outside of acquisitive materialism.

The emerging world view emphasizes both the importance of individual responsiblity and the need for decentralized institutions to provide greater opportunities for self-determination. In a sustainable community, empowered citizens demand active participation in their government, corporations and any other institutions that they create to govern themselves. Participation is a means of ensuring that citizens are not puppets of forces beyond their control. Ideally, decisions are best made by the people who will be living with the consequences of their decisions both in terms of implementing the decisions and monitoring their impact. Robinson et al (1990:44) conclude that socio-political sustainability requires:

an open, accessible political process that puts effective decision-making power at the level of government closest to the situation and lives of the people affected by a decision...There should exist at least a minimum level of equality and social justice, including equality of opportunity to realize one's full human potential, recourse to an open and just legal system, freedom from political repression, access to high quality education, effective access to information, and freedom of religion, speech and assembly.

The shift to sustainable communities will require a change in people's attitudes, a renewed sense of responsibility for themselves and the community, and a change in our institutions to make them more open to active involvement from the community. Dauncey (1988) suggests that a successful community based on active participation will require:

1. decentralization of power to make local government more accountable to its citizens;

2. evolution of community democracy to allow people to be responsible for creating their own unique solutions to local problems;

3. shifting from dependence on local administrators to community development workers who are trained to help local people meet, share concerns and organize to act in a positive way to create change;

4. practising integrated policy-making and community budgeting that addresses community problems in an holistic manner and selects solutions that deal with the cause of the problems as opposed to the symptoms. It also requires full participation from community members, development of a vision for the community's future, bottom-up organization and top-down facilitation for change; and

5. co-operation from all members of the community, regardless of their political affiliation, to work towards a common goal.

In order for a community and its citizens to take control of it future, it must determine what its future could be, based on the values and desires of the people, and set goals to move toward that future. Any strategy to work towards these goals requires an assessment of the problems that the community faces, an understanding of how these problems interact and a search for integrated solutions that are appropriate to the local

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situation.   To be successful, a new community future needs the full support and participation of community members.

Creating a Sustainable Economy

Principle 10: A sustainable community has a sustainable or steady state economy.

Implications of Principle #10

-Communities should ensure that all economic activities are ecologically sound (See Principles #1-5).

-Communities should encourage local economic self-reliance and self-sufficiency.

-Communities must ensure that the full environmental and social costs of engaging in a particular economic activity are factored into the price of the final product.

-Communities should measure their economic development with a new indices such as the Index of Sustainble Economic Welfare (Daly and Cobb 1989).

-Communities should eliminate their dependence on large scale energy sources (e.g. nuclear, hydro electric, coal) by investing in small scale, locally-based, renewable energy sources (e.g. solar, geothermal, wind).

-Community economic activity should select technology that meets the needs of the community (e.g. labour intensive if unemployment is a problem, environmentally benign)

One of the greatest failures of western society has been to allow our economic system to operate as if it were independent of the natural world. By not recognizing that it is a subsystem of the biosphere, we have allowed ourselves to persist in the illusion that continuous economic growth (defined as the increasing consumption of material goods) is not only possible but is also desirable. As noted by economist Nicholas Georgescu-Roegen (1977), no economic system can survive without a continous inflow of energy and matter

from the earth. Since the biosphere (and its component ecosystems) operate in a steady state, the economy which is a subsystem of the biosphere should also be in a steady state. The simple fact that non-renewable resources are limited and the productivity of our renewable resources is limited by the energy flow from the sun implies that our consumption of these natural goods is also limited.

Achieving balanced development to meet the physical, social, and spiritual needs of humanity through a sustainable economy is a major implication of the emerging world view. The design of a sustainable or steady state economy should be based on the biological concept of homeostasis. Daly (1988) characterizes a steady state economy as one in which:

1. the human population is constant;

2. the stock of physical wealth is constant;

3. the level at which the population and stock of wealth are maintained provides a good life for a long future; and

4. the rate of throughput of matter and energy to maintain the population and wealth is minimized.

Consequently, Daly (1988) suggests that the institutional changes needed to move us gradually toward a steady state economy must be focused at putting limits on population, throughput and inequality. In other words we require an economy that is ecologically sound and focused on the goal of meeting human needs.

Sale (1980) argues that many of our social and environmental problems have developed from the fact that we have allowed the major forces in our lives (corporations, government and technology) to become too big. He proposes that we need to develop a human-scale economy based on small-scale community and local economic enterprises for two reasons: 1) smaller industries generally minimize adverse impacts on the local ecology

and 2) smaller enterprises are more amenable to local control. According to Sale (1980:353):

> If a human-scale economy means anything, it means the elimination of such conditions of totalitarianism and the creation of workplaces where individual humans can have a full and constant voice in the matters that affect all aspects of their working life. It means, in short, democracy in the workplace.

In addition to size, a sustainable economy emphasizes self-reliance. Building a local economy to meet local needs serves many of the goals of a sustainable community and can act as a buffer against world economic crises. With the control of community-based enterprises placed in the hands of community members, public opinion and local by-laws will be more successful in ensuring that these enterprises are responsive to the needs of the community and are socially and environmentally responsible. Local experiments in self-reliance have several advantages: 1) due to their size, there is a minimal risk of financial loss if the project fails; 2) since each community will approach their problems differently, there is a diversity of experimentation; 3) they are economical since they recycle money internally; and 4) they improve decision making at the local level (Morris 1990).

A sustainable economy will require new measures to monitor success or failure. From an ecological perspective the gross national product (GNP) is misleading for two reasons: 1) it measures income from all economic activity as positive contributions whereas some activities such as the of clean up environmental disasters should be deducted as a negative contribution to GNP; and 2) it does not measure the declining state of the environment from which the community's income is derived. Alternatives to the GNP could include a community welfare index measuring net economic activity (adjusted for social and environmental costs); an index of sustainable economic welfare (Daly and Cobb

1989), a balance sheet of use and resources showing our account with nature; or a human

settlements balance sheet.8

As with large-scale corporations and government, large-scale technology (e.g. mega

energy projects, capital-intensive farming and fishing) has facilitated massive

environmental destruction by industrial society. A sustainable community must be in

control of technology and not controlled by it, which is the case in many one industry

communities (such as communities dependent on oil and mineral extraction, industrial

forestry, nuclear power). Appropriate technology (also known as human-scale, alternative,

intermediate or soft technology) is technology which is designed to meet human needs and

capabilities and operate within the limitations of the environment. More specifically, it is

technology which is small-scale, ecologically sound, requires minimal energy and capital

input and is easily understood (Schumacher 1973, Sale 1980). Communities must analyze

their economic development, transportation, energy, and waste management options on the

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8. New models for measuring sustainable living

Balance sheet of use and resources:

"Such a balance sheet would state how the real "capital stocks" - species diversity,
soil fertility, forests, water, air, mineral and energy reserves, and human potential -
had fared in the past year. It would also analyse the "throughput" of production and
consumption in terms of costs and benefits. Costs include protecting or repairing the
stock, unrepaired damage or depletion, and all non-productive costs such as military"
(Barnaby 1988:231).

Human Settlements Balance Sheet:

"Capital: Sanitation, water supply and housing improved, green areas extended;
human capital enhanced; support base from water-sheds, soil, forests and rural
communities protected.

Throughput: Resources consumed and costs of health and pollution repair and
environmental impacts (near and far), balanced against benefits." (Barnaby 1988:231)

TABLE III

PRINCIPLES OF A SUSTAINABLE COMMUNITY

1) Preserving Biological Diversity

   A sustainable community recognizes that all life forms are connected through natural processes and that each component plays a part in preserving the integrity of the overall ecosystem. Therefore the community strives to preserve the biological diversity of the bioregion.

2) Maintaining the Productive Capacity of Ecosystems

   A sustainable community lives within the ecological carrying capacity of the bioregion by ensuring that it does not consume more than local ecosystems are capable of producing within a reasonable management cycle. This will ensure that the productive capacity (the flow of energy and materials) of local ecosystems is maintained.

3) Integrating Urban Functions with Nutrient Cycles

   A sustainable community recognizes the essential role of the flow of nutrients to the integrity of ecosystems and ensures that the quantity and content of nutrients transferred between bioregions is balanced.

4) Minimizing Energy and Resource Consumption

   A sustainable community minimizes the flow of energy and material resources through the bioregion.

5) Achieving Dynamic Equilibrium between Human and Natural Systems

   a) A sustainable community should be designed as a homeostatic system and be flexible to adjust to short-term fluctuations and long-term shifts in ecological systems.

   b) A sustainable community recognizes that the current state of our knowledge of natural systems does not allow us to predict all the potential adverse impacts of human interference in those systems.

6) Developing Values for Ecological and Social Sustainability

   A sustainable community has a citizenry that is spiritually aware, socially responsible and feels empowered to act.

7) Meeting Basic Human Needs

   A sustainable community ensures that the basic human needs of the population (energy, food, water, housing, employment, healthy environment, education) are met.

8) Achieving Equity

   A sustainable community strives to achieve social equity both within the community and internationally.

9) Promoting Self-Determination

   A sustainable community promotes self-determination.

10) Creating a Sustainable Economy

   A sustainable community has a sustainable or "steady state" economy.

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basis of whether the technology employed in these areas is appropriate from an ecological and social perspective.

SUMMARY

Current ecological theory and social research appears to support principles for a sustainable society which are consistent with the emerging ecological world view. The principles outlined in this chapter are presented as a preliminary basis for guiding communities toward sustainability. They indicate that communities must be concerned with maintaining both ecological and social sustainability. The implications of these principles for community institutions, policies, and decision making are far reaching and will require tremendous community debate and support before they are accepted. Future research in this area could provide further definition of these principles and ensure that all the critical elements to sustainability are reflected.

CHAPTER IV - SHIFTING PARADIGMS

Having described the characteristics of a new ecological paradigm and its implications for communities, an examination of the process of changing world views and the impediments to such change will provide guidance on the kinds of activities that should be undertaken at the community level to promote social change.

It is difficult to determine how a shift in world views takes place, whether it occurs as a result of conscious human effort according to some grand scheme or whether it simply evolves as new ideas filter through society and begin to change the way we operate on a daily basis. Western society experienced a paradigm shift during the Renaissance. Descartes, Bacon and Newton may have played critical roles in formulating the scientific principles which became the basis for the new paradigm; however, their ideas were dependent on the discoveries of Galileo and Copernicus to shake the foundations of the previous paradigm, and the writings of eighteenth century authors such as Locke (1969) and Smith (1961) to translate these ideas into a philosophy for human understanding and for organizing human activity.

Kuhn (1970) suggests that the transformation of a scientific paradigm occurs as a result of a crisis. The paradigm is questioned because of this crisis, a new paradigm is created to explain the new reality, it is tested, and finally accepted. In contrast Prigogine and Stengers (1984) suggest that scientists are continually researching questions (both scientific and philosophical) that remain unanswered by the current paradigm. They also suggest that the cultural and social context has a significant impact on which questions and answers are more relevant at a particular point in time.

Whatever the case, it is clear that our current paradigm is no longer adequate to explain the reality we experience, a new paradigm is already emerging and the next step

must be to transform human society to better reflect our understanding of the world around us.

IMPEDIMENTS TO CHANGE

The impediments to change come from several major areas: 1) the failure to recognize the need for fundamental change; 2) the fear of change; 3) the feeling of impotence in the face of massive problems; 4) the failure to recognize or design alternatives; and 5) the tremendous inertia built into modern institutions and supported by those with vested interests in the status quo who resist change .

The first three impediments are characteristic of individuals. Failure to recognize the need for fundamental change stems primarily from failing to diagnose correctly that the root of our environmental and social problems lie deep within the foundations of society in the reductionist world view. We also suffer from a lack of knowledge (e.g. insufficient data, lack of "scientific" proof) of the current state of the environment and the basic priciples of ecology. In addition, our evaluation of the threat to our survival is clouded by our continuing faith in science and technology as a saviour. Some who recognize the seriousness of the threats fail to act out of fear of change or a feeling of powerlessness. Lack of alternatives can be a societal impediment if the alternatives are not available; however, we often fail to recognize that alternatives do exist in places we have never looked before. The final impediment, institutional inertia, is characteristic of society. Even when change is necessary our institutions resist any proposed change.

Skinner (1987) identifies two major reasons as to why we are not currently acting to "save the world". The first is the process of natural selection to which humans are subject. Natural selection prepares a species for a future that resembles the selecting

past. Unfortunately, we are facing a future that may be significantly different from our past. The second is education which reinforces selected traits and causes them to persist long after the conditions responsible for their selection have changed. This is particulary dangerous when the changes have been caused by the selected traits. For instance, our reductionist world view has given us a competitive advantage in the natural world but it is also responsible for changes in the environment that compromise our future. Despite these changes, we resist any suggestion that the reductionist world view has serious flaws and continue to teach it to our children.

Ornstein and Ehrlich (1989) contend that the human mental system fails to comprehend the modern world because our conscious is biased toward the short term. Our memory simplifies what we remember by allowing critical matters to retreat into the background while we concentrate on current less important concerns. We also have a tendency to forget the seriousness of a crisis after it has passed. In addition, they suggest that our nervous system detects only dramatic change. As a result, we tend to respond immediately to emergencies but fail to comprehend slow, long term trends (such as environmental degradation) that are equally devastating.

Despite these impediments, industrial society may already be experiencing creative disintegration (Roszak 1978, Dauncey 1988, Henderson 1987) as part of an evolution toward a more humane society. However, resistance to change will continue to occur because innovation is risky, change is threatening and the members of society that currently benefit from the status quo have much to lose.

SUPPORTING TRANSFORMATION

> Concerned individuals could incite a wide-ranging transformation of values and goals if they joined together with full knowledge of the goals pursued today, of the nature of the required global goals, of the gap between them, and of the motivating forces that could close the gap. Such a transformation of values and goals may be more important at the present time than the specification of further models, plans, and strategies, however expertly it may be done. Without the will to create a global community of peace, human fulfillment and solidarity, the best-intentioned plans for reform will not be carried out. (Laslo et. al.Goals of Mankind 1977:xv)

Creating a new society requires both a shift in our world view and fundamental social change. This implies that efforts must be made at the individual, family and societal level to create change. While working towards the same ends, the methods will be different. It would be difficult to prove whether individual change must precede societal change. However, it is logical to believe that some individuals, primarily intellectuals and other leaders, must experience a transformation in order to act as catalysts for social change.

In a survey of individuals committed to social change, respondents identified personal example as the most effective method of social change in terms of their own experience (Ferguson 1980). This was followed by support networks, electronic media, winning over influential persons and public education as less effective but useful methods. This observation supports the old adage that "you must practice what you preach" and lends credence to the idea that personal transformation must precede societal transformation.

There are many theories considered useful to the study of attitude and social change. A thorough examination of each of these would be an enormous task and is not considered necessary in the context of this thesis. However, a survey of the some of this

literature is required to provide guidance on effective methods that could be used by individuals and planners to sow the seeds for fundamental change. No method is sufficient to bring about radical change. It is a question of determining which method is most appropriate given the circumstances. A review of the Rokeach belief system and innovative learning theories will shed some light on the potential of changing people's attitudes and the underlying set of beliefs that form our world view. Diffusion provides a theory on how new ideas or innovations are communicated through society. The theory of self-organizing systems structures is examined for its potential application to change in human social systems. Finally, social mobilization is discussed to provide a basis for encouraging grassroots or community movements to facilitate change.

Rokeach Belief System

Rokeach (1979) describes an individual's belief system as the combination of beliefs around the individual self, his/her organization of values, and the value-related attitudes that an individual holds toward objects and situations. He also contends that "this structure of beliefs, attitudes, and values is organized to serve primarily the maintenance and enhancement of self-esteem" (Ball-Rokeach et al. 1984:27). The belief system, like our world view, operates silently. People are generally unaware of the impact their belief system has on their perception of reality or are even ignorant that the belief system exists. This lack of self-knowledge is attributed to the complexity of belief systems, our intellectual limitations, and our tendency to protect the beliefs that define who we are.

The more central a belief (i.e. there is 100% consensus with other people), the more difficult it is to change. Rokeach contends that intentionally changing a person's values by creating discrepancies within their belief system can be a powerful tool in modifying

attitudes and behaviour. The implications of Rokeach belief system theory for aiding in changing our world view are:

1) We must identify those values or beliefs which are driving our negative behavior (e.g. humankind is separate from and superior to nature).

2) We need to devise means of creating dissatisfaction with those beliefs (e.g. making it socially unacceptable to be ecologically irresponsible).

3) We must provide alternatives to those beliefs (e.g. a new ecological world view).

Innovative Learning

Innovative learning (Botkin et al 1979) is a means of improving our ability to cope with complexity. Traditional or maintenance learning tends to deal with complexity by promoting the simplification of reality. It is analytical and rule-based which is appropriate in situations where underlying assumptions remain fixed. Innovative learning occurs when fundamental values are challenged. Unfortunately, centralization and hierarchy (the foundation of the status quo) tend to stifle innovative learning. As a result, societies tend to wait for a crisis to stimulate innovative learning.

The objectives of innovative learning are to achieve individual autonomy (e.g. independence, self-reliance) as well as integration (e.g. interdependence, co-operation) (Botkin et al 1979). The main features of innovative learning are anticipation and participation. Anticipation is the capacity to face new situations by creating alternative futures and selecting plans and actions to bring them about. Since innovative learning is a creative effort, it requires active participation to develop a common understanding of problems and to form a consensus on solutions. Innovative learning also promotes an integrative form of thinking essential to evaluating the long term consequences of present

decisions, considering second order consequences (i.e. side-effects), systemic thinking (i.e. seeing the whole as well as its parts), and to detecting and assessing interrelationships within social, economic or environmental systems. Innovative learning requires that people are aware of structural conditioning (such as their world view) and manipulation of their behavior. The implications of innovative learning for changing our world view are:

1. We must be made aware of our fundamental beliefs (e.g. world view).

2. In the face of unprecendented change, we must anticipate change by creating the future and finding ways to bring it about.

3. People must actively participate in sharing knowledge and developing a common understanding of problems and solutions.

4. We must understand the interconnections and interdependencies of problems to find appropriate solutions.

Diffusion of Innovation

To promote a shift in world view we must understand how new ideas or innovations are spread through the general population. Diffusion theory (Rogers & Shoemaker 1971) explains the process by which new ideas spread to the members of a social system. It describes social change as three part sequential process: development of a new idea or innovation, diffusion of that idea to the public and the consequences as a result of the adoption or rejection of the innovation. Although most of the research in diffusion theory relates to innovations of a material or technological nature, the theory offers some insights into the diffusion of ideas such as a new world view.

The key elements which affect the effectiveness of diffusion are 1) the innovation, 2) the communication channels used to transfer the ideas, and 3) the social system through which the ideas are being diffused. An innovation "is an idea, practice, or object perceived

as new by an individual" (Rogers and Shoemaker 1971:19). The rate of adoption of an innovation can be affected by several factors. Innovations are more readily adopted if the innovation is perceived to be advantageous; it is compatible with existing values, past experiences, and the needs of the receiver; the innovation may be experimented with on a trial basis; or if the innovation is observable to others. Innovations which are complex and require the adopter to develop new skills and understandings are more difficult and slower to diffuse.

Diffusion is also affected by the choice of communication channel. In general, if the object of the communicator (the person wishing to communicate the innovation) is to make people aware of the innovation, mass media channels such as television, radio, film, newspapers etc. are the most rapid and effective means of reaching a large audience. However, if the communicator wishes to persuade people to form a favourable attitude toward the new idea, a method involving face to face exchange is more effective.

Social structure can impede or facilitate the rate of diffusion. For instance, social norms, such as the free market could be a facilitator to change, whereas property ownership is likely to be a barrier to change. Some ideas, such as a paradigm shift, are "restructuring" innovations that change the social system itself. According to diffusion theory, it is possible to speed the rate of diffusion by first introducing restructuring innovations to the social system which will facilitate the adoption of an innovation.

Individuals can play quite different roles in influencing the system and the pattern of diffusion. Opinion leaders can influence other individual's attitudes or behaviour. Their leadership is earned by their competence, social accessibility and conformity to the system norms. Change agents can influence decision-makers to adopt or reject an innovation. Change agents may also use opinion leaders to promote an innovation.

The implications of diffusion theory for changing our world view and creating social change are:

1. To improve the rate of adoption of a new world view and a new lifestyle, we must show how a paradigm shift is not only advantageous but necessary.

2. A paradigm shift is a complex idea which is not compatible with past values and experiences therefore we can expect that it will take a great deal of time to diffuse through society.

3. People can be made aware of the need for a new world view or new ecological lifestyle through mass media communication but personal interaction is needed to change behaviour.

4. Acceptance of a new world view, a restructuring innovation, could speed the rate of societal change.

5. Identifying and persuading opinion leaders and change agents of the need for change should speed up the process of diffusion.

Theory of Self-Organizing Systems

The theory of self-organizating systems (Prigogine and Stengers 1984) has been applied to social problems such as the evolution of urban form (Marchand 1984), planning and environmental management (Slocombe 1985, Grzybowski and Slocombe 1988). Although identifying and quantifying appropriate variables makes the application of this theory to human problems difficult, examining social systems in the context of the natural laws that operate for other life processes is valid if we really consider humanity to be an integral part of this planet's ecology.

Human social systems have some of the same characteristics of self-organizing systems in that they are open, complex systems that depend on energy flow through to maintain their structure; they have complex non-linear interactions between their elements; and, they are subject to fluctuations (Prigogine et. al. 1977). For example, the

structure of our modern industrialized society is maintained by an increasing flow of highly concentrated fossil fuel energy. Also, societies are made up of individuals that interact in a co-operative or conflicting manner to attain their goals, and fluctuations in society often occur as a result of these interactions. As a result, of these similarities it is reasonable to assume that human societies may be subject to the same kind of processes that will result in a system reorganization.

The increasing frequency of fluctuations in both human and planetary support systems (e.g. behavioural changes brought about for example by the environmental movement and the rise of democracy in the Soviet Union; abnormal weather patterns throughout the world and environmental disasters) seem to suggest that human social systems and the biosphere may be headed toward a transition or bifurcation. If this is the case, humanity may need to become skilled at "riding the tiger of change" (Henderson 1987) and becoming "managers of crisis" (Theobold 1987). Unfortunately, there is no guarantee that a new biophysical system created from such a sudden transformation will be conducive to human life.

Henderson (1987) describes three zones of transition that society will experience as we move to a society based on a new world view. The Breakdown zone is characterized by the destructuring of obsolete institutions (including cities, suburbs, cultural and political forms), conflicting cultures and ideologies and many slow moving crises (e.g. global warming). The Bifurcation zone is a time when our assumptions, priorities and goals (and our world view) must be reexamined. High risk strategies bringing change may prove successful whereas doing nothing will be disasterous. The Breakthrough zone is characterized by the growth of citizens' movements, the fall of tyrannical regimes, and the development of a new style of industrialism based on participatory organizations, co-

operatives, worker owned smaller business and production methods that are within ecological tolerances.

Agents for social change must recognize we can no longer assume the future will be an extrapolation of past trends. Achieving effective, large-scale change will require individuals who develop a vision of the future and individuals who work to implement change. Change agents must draw attention to problems and possiblities when people seem ready to deal with them positively and intelligently. They must be skilled communicators to convey the potential of the new vision. They must ensure our basic assumptions (our current paradigm) are always challenged.

The implications of the theory of self-organizing systems to promoting social change are:

> 1) The reorganization of society, although preceded by a period of intense fluctuation and instability, will likely come as a surprise event. It is possible that a single variable, such as an individual or small group of individuals could act as change agents, impacting at a critical point in time could be sufficient to trigger a transition.

> 2) We should be monitoring critical variables in both the human and biophysical systems (e.g. energy and material flows, absorptive capacity of natural environment to process waste, social factors such as disease and poverty) to help us anticipate sudden change. Anticipating the future will depend less on extrapolating past trends than incorporating uncertainty and the potential for discontinuous change into the planning process.

Social Mobilization

The theory of social mobilization (Friedman 1987) suggests that the thrust for transformative structural change must come from below (e.g. the grassroots movements). with the primary goal of recovering political community currently dominated by the state and capital. Social mobilization involves working to equalize people's access to bases of

social power (participatory democracy), asserting people's sovereign will over the state and the economy (regionalism), and selectively replacing the dominant market system with a system that meets social, environmental, economic, political and cultural development objectives (collective self-reliance). The energy behind these changes is the efforts of individuals in action groups, networks, coalitions and formal organizations working at the local or community level (empowerment).

Friedman (1987) believes that the effectiveness of social mobilization as a means of creating fundamental change depends on developing an appropriate theory for structural transformation. Otherwise local efforts will be superficial and reactive. This theory must be based on actual experience of efforts to create change. It must focus on the structural problems of society, provide a critical interpretation of existing reality, predict the future assuming the absence of fundamental change, provide images of an alternative future as a result of emancipatory efforts, and suggest the best strategy for overcoming resistance of established powers against change.

Some of the implications of social mobilization include:

1) The impetus for social change must come from within the community.

2) Fundamental change requires collective self-empowerment to equalize the access to social power.

3) Local efforts to create social change must be guided by the global context of environmental and social problems and an overall theory of transformation.

4) Social mobilization requires change agents who are skilled communicators and facilitators.

SUMMARY

These theories identify a number of factors that are important to facilitating a change in our world view and fundamental social change. They imply that in the face of unprecedented change we need to anticipate the future and create ways to bring it about (Innovative learning, Self-organization). Challenging our current world view is required to facilitate the acceptance of new ecological values (Rokeach belief system), and to release our capacity for integrative thinking and creative problem solving (Innovative learning). A shift in world views will take time but it will facilitate further behavioural change in individuals and society in general (Diffusion). Change agents can play an important role in promoting new ideas through appropriate channels thereby influencing the speed of social change (Diffusion, Self-organization, Social Mobilization). Active participation in the process of social change is needed to develop a common understanding of problems, support for solutions (Innovative learning, Social mobilization) and to promote behavioural change (Diffusion).

CHAPTER V - MODELS OF SUSTAINABILITY

The need for a change in world view (Chapter II), the principles for sustainability (Chapter III), and theories of social change (Chapter IV) were explored to provide a basis for evaluating several recent initiatives aimed at making cities and communities more ecologically and socially sustainable. Certainly no initiative will be sufficient to create a sustainable community or society. However, analyzing each example according to a consistent set of criteria provides insights into the strengths and weaknesses of various approaches and points to ways in which they could be improved.

The initiatives selected for examination are from Canadian communities with the exception of the Global Action Plan for the Earth and the San Francisco Green City Program. They have been selected for two reasons: 1) the projects represent a wide range of approaches to creating sustainable communities, and 2) information on Canadian projects was easily accessible.

CRITERIA FOR EVALUATION OF MODELS

Five of these initiatives (the Canadian Healthy Communities Project, the Clayoquot Sound Sustainable Development Task Force, the Clayoquot Sound Sustainable Development Strategy, the Global Action Plan for the Earth, and the Toronto and Vancouver global warming initiatives) are reviewed in detail according to the following criteria developed from the theory in Chapters II, III and IV respectively. Brief descriptions and preliminary evaluations of additional initiatives (Peterborough Sustainable Development Round Table, Burnaby Economic Strategy and State of the Environment Report, San Francisco Green City Program, Waterloo State of the Environment Report, Turning 2000 Project, Waging Peace, Community Land Trusts, Community Economic

Development, and the Federation of Canadian Municipalities International Program) are included in Appendix I as a resource for communities considering similar actions and as a basis for future research. Table IV identifies the extent to which all these initiatives meet (or have the potential to meet) the above criteria and highlights significant areas where more work is needed.

Criteria #1 - A New World View:

> Does the initiative challenge the existing world view (as described in Chapter II)?

Criteria #2 - Substantive Changes for Sustainable Community Development

> Does the initiative reflect/promote some (or all) of the principles of ecological sustainability (e.g. biodiversity, carrying capacity, nutrient cycling, minimizing consumption, achieving dynamic equilibrium) and social sustainability (e.g. changing values, meeting basic needs, equity, self-determination, sustainable economy) in community development (as described in Chapter III)?

Criteria #3 - Procedural Changes for Community Transformation

The essential components of a process of social and institutional change include mechanisms to promote consensus building, goal setting, integration of actions, and implementation. These components are examined in detail in Chapter VI with reference to the important factors to facilitating social change (outlined in Chapter IV) which are characteristic of some of these larger components.

In summary, consensus building in a community involves both education about ecology and the dominant world view, and extensive public participation in assessing community problems and finding creative solutions. Goal setting mechanisms encourage

the creation of a new vision for the future of the community. Integrating mechanisms are needed to develop an holistic approach to creating and implementing solutions. Consequently, the sustainable community initiatives are evaluated with specific reference to whether the initiative promotes social transformation through:

I. CONSENSUS BUILDING:

Education: does the initiative encourage a change in values through education?

Active Participation: does the initiative involve change agents and active citizen participation to promote behavioural change and individual empowerment?

II. GOAL SETTING:

Anticipating the future: does the initiative develop a sense of common purpose through community goals?

III. INTEGRATION

Does the initiative include mechanisms to ensure that all the substantive principles of sustainability are addressed and integrated solutions are proposed?

Since most of these initiatives are in early stages of development, it is premature to attempt a consistent assessment of these initiatives in terms of effective implementation mechanisms (the final component for a process of change).

SUSTAINABLE COMMUNITY INITIATIVES

Canadian Healthy Communities Project

The World Health Organization developed the Healthy Cities project (Healthy Communities in Canada)9 as a program for achieving its goal of providing health for all by the year 2000. The Healthy Communities project introduces an integrated approach to an individual's health problems by focusing on prevention rather than on treatment of disease. It promotes a concept of health that is not just the absence of disease but an individual's complete physical, mental and social well-being, including the ability to achieve one's potential and to respond positively to changes in one's environment. The Healthy Communities concept assumes that you can not look at health care in isolation from the quality of enviroment, poverty and other societal problems.

The Healthy Communities project has been initiated in more than 38 European cities and many Canadian cities. The criteria for participating in the project requires an endorsement by the municipal council, demonstration of intersectoral collaboration, community consultation, development of a municipal health strategy, a process to evaluate progress, and sharing of information with other communities. The approach taken to implement the project varies from community to community.

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9. Information on Healthy Communities initiatives was obtained from Susan Berlin, Coordinator, Canadian Healthy Communities Project, 126 York St., Suite 404, Ottawa, Ontario, K1N 5T5, Tel: (613) 233-1617

Evaluation of Healthy Communities Project

By addressing human health in terms of the interrelationships between environmental and social degradation, the healthy community concept is an example of an holistic approach which is consistent with some elements of the emerging ecological world view.   It also reflects some of the substantive principles of ecological and social sustainability (primarily those of promoting new values, meeting basic needs, achieving equity, and promoting self-determination), as indicated in the Healthy Communities Project Outline (1988):

> Part of what makes a community healthy is a process whereby municipal government and local citizens are providing leadership to enhance healthy development and reduce inequalities...[it] requires local action in areas such as education, housing, urban planning, economic development, environmental hygiene, multisectoral action, or healthy public policy.

The Toronto Board of Health in their Healthy Toronto 2000 report took a similarly holistic approach to applying the healthy communities concepts by making recommendations aimed at improving the quality of life in Toronto, and addressing such wide ranging concerns as reducing inequities, creating healthy physical and social environments and promoting community-based health services.

The emphasis on human health makes the project appealing to an anthropocentric society; unfortunately, the application of the concept in some communities may relegate ecological sustainability to a secondary concern. In order to use the healthy community approach for creating sustainable communities, the concept must be further articulated to ensure that both environmental and social concerns are adequately considered in implementing Healthy Community initiatives.

A major strength of this project is its emphasis on developing a consensus building process to implement the healthy communities concepts. Active community participation

is encouraged through community task forces, public consultations and volunteer programs to assist citizens in identifying their own health issues, to increase control over their health care, and to promote behavioural change. For instance, the Toronto Healthy Communities Office is currently planning a series of public consultations to develop a collective vision of the future of Toronto, and to develop a State of the City report to assess the current status of all aspects of health in Toronto. Similarly, the Healthy Communities Project sourcebook recommends the desirability of involving change agents and community opinion leaders in implementing activities to ensure the overall success of the project. Although the extent of community involvement in the process can vary from project to project, building a community consensus on health issues is considered to be an integral part of the healthy communities concept.

While Healthy Communities initiatives are community-based initiatives, a national administrative office provides a means of facilitating information exchange and co-ordinating activities between Canadian and international communities on which projects provide the most successful results and allows communities to feel that they are part of an international effort to improve community health.

TABLE IV
SUMMARY OF SUSTAINABLE COMMUNITY INITIATIVES

INITIATIVE	I. Challenge to Existing World View	II. Biodiversity	Carrying Capacity	Nutrient Cycling	Minimizing Consumption	Dynamic Equilibrium	Changing Values	Meet Basic Needs	Equity	Self-determination	Sustainable Economy	III. Consensus Building	Education	Active Participation	Goal Setting	Anticipating the Future	Integration
Canadian Healthy Communities Project							X	X	X	X		X	X				X
Clayoquot Sound Sustainable Development Task Force												X	X				
Clayoquot Sound Sustainable Development Strategy	X	X	X	X	X	X	X			X	X	X	X		X	X	
Global Action Plan for the Earth		X	X	X	X	X						X	X				
Community Global Warming Initiatives		X	X	X													
Sustainable Development Round Tables – Peterborough										X	X	X	X				
Burnaby Economic Strategy & State of the Environment Report						X	X	X	X	X		X	X				X
San Francisco Green City Program	X	X	X	X	X	X	X			X	X	X	X		X	X	
Waterloo State of the Environment Report		X	X	X	X	X		X			X	X	X		X	X	
Turning 2000 Project		X	X									X	X				
Waging Peace	X							X		X		X	X				
Community Land Trusts								X	X				X				
Community Economic Development									X				X				
International Programs – Federation of Canadian Municipalities									X	X		X	X				

X – Principle Specifically Addressed by Initiative

Clayoquot Sound Sustainable Development Task Force

The Clayoquot Sound Sustainable Development Task Force10 was established by the Provincial government in August 1989 in response to continuing conflicts between the forestry, fisheries, and wilderness tourism interests in the area (Hoyt 1990) and a proposal from the District Council of Tofino and the Tofino-Long Beach Chamber of Commerce on the need to prepare a Sustainable Development Strategy for the region (discussed below). The Task Force consists of members representing the major stakeholders in the community's economic future: the three impacted communities (Tofino, Ucluelet and Port Alberni), the Provincial government ministries (Environment and Regional and Economic Development), the Regional District, the forest companies, the forest workers union and the local Tribal Councils.

The Terms of Reference for the Task Force state that it is to operate on a consensus basis as a dispute resolution mechanism with the primary objective of preparing a sustainable development strategy to address all aspects (e.g. social, economic, aesthetic) of present and future development in Clayoquot Sound. The chairman of the Task Force was appointed as an independent mediator to facilitate the consensus building process. The Task Force has formed a number of negotiating committees to work on defining the specific interests of each sector (Aquaculture, Environment, Fishing, Forestry, Government, Heritage, Jobs, Mining, Tourism) and developing draft agreements which will be used by the full Task Force to resolve the outstanding conflicts.

10. Information on the Clayoquot Sound Sustainable Development Task Force was obtained from documentation provided by the Task Force co-ordinator: Clayoquot Sound Sustainable Development Task Force,4th Floor, 712 Yates Street, Victoria, British Columbia, V8V 1X5,

Given the nature of the conflicts and the variety of jurisdictions and stakeholders involved (e.g. local, Native, Regional and Provincial governments, multinational corporations, environmental groups, labour), it is not surprising that the Provincial government decided that a dispute resolution process emphasizing consensus building was needed to create a sustainable development strategy. The Task Force must decide what sustainable development11 and a sustainable development strategy will mean for their region. The Task Force is currently considering whether the strategy should be a planning process to define a specific plan for the development of the area or whether it should define a process for achieving community consensus and a set of values to guide future development. The Task Force's final recommendations must be approved by the Provincial Cabinet.

Evaluation of Clayoquot Sound Task Force

This initiative does not challenge the existing world view nor does it promote the understanding or acceptance of a new world view. The initiative is designed as a conflict resolution mechanism rather than as a means to understand need and direction of fundamental change.

The strength of this initiative is its emphasis on consensus building to find solutions to issues that have created intense conflict in the community. Social change to create

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11. The term sustainable development has been faulted for promoting what appears to be an ecological impossibility: continued material economic growth and a sustainable environment (Rees 1990, Jacob 1988). Although it is true there are those who cling to the status quo and interpret sustainable development to mean sustained economic growth (e.g. NTFEE 1987), there are others who are using the contradictions to promote a broader definition that considers environment, economic, cultural and social concerns (Robinson et al 1990, Gardner and Roseland 1989b, Rees 1989).

sustainable communities will not come without conflict; therefore, it is important that dispute resolution mechanisms be part of any change process. However, trying to develop a strategy for sustainable development based on negotiated agreements between vested interests assumes that those represented at the negotiating table will bring forward all the concerns of the community and will act fairly on their behalf. In addition, without an overall framework based on sustainability principles, the final outcome may be the best agreement possible among the various stakeholders but it may not represent sustainable development. In addition, consensus building on the nature of sustainable development and how it applies to Clayoquot Sound may require more time than perhaps this Task Force has been allowed given its mandate to report within one year.

The existence of conflicts over the appropriate use of natural resources (e.g. clear cut logging versus wilderness based tourism and small-scale aquaculture) indicate that there are conflicting values within the community. The process to obtain consensus among stakeholders will provide an opportunity to bring these conflicting values into the open for public discussion. In addition, the community relations component of the Task Force, originally designed to ensure that the credibility of Task Force is maintained, could also act as a means of diffusing the results of this initiative to resolve resource conflicts and developing community consensus on the direction of a sustainable development strategy.

The major weakness of this initiative is that it fails to articulate the ecological and social sustainability principles that would guide the process toward acceptable alternatives and to ensure that all aspects of sustainability are considered equally. In particular, the focus on local issues and on conflict resolution may exclude global issues such as the community's response to global warming or international equity from the discussion of sustainable development. In addition, the failure to have adequate guidelines or "a bottom

line" on sustainability, leaves the process open to abuse by powerful vested interests who may apply pressure to ensure that sustainability is defined in their terms, leading to the implementation of alternatives that meet their own rather than community objectives. The success of this initiative could be improved considerably if it is integrated with the community-based Clayoquot Sound Sustainable Development Strategy initiative described below.

Sustainable Development Strategy - Clayoquot Sound, British Columbia

In May 1989, the Steering Committee for Sustainable Development, consisting of the District of Tofino and the Tofino-Long Beach Chamber of Commerce, presented a proposal to the British Columbia government requesting support for the preparation of a community-based Sustainable Development Strategy for the Clayoquot Sound region[12]. The Province responded by establishing the Clayoquot Sound Sustainable Development Task Force (discussed above). While the Steering Committee is taking part in the Task Force's efforts, it has also decided to continue with the preparation of a Strategy as outlined in their proposal. To date several preliminary sectoral studies have been completed and others are in process or waiting for additional funding.

The Sustainable Development Strategy for Clayoquot Sound[13] project proposal takes a broad perspective on sustainable development and defines it as development that is

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12. Information on the Sustainable Development Strategy for Clayoquot Sound is based on documentation received from the Sustainable Development Steering Committee, Lorna Walsh, Community Coordinator, P.O. Box 9, Tofino, British Columbia, V0R 2Z0.

13. Sustainable development strategies or conservation strategies have recently emerged as a tools for comprehensive environment and development planning to develop an integrated (rather than sectoral) response to economic, social and environmental problems. The conservation strategy was originally conceived by the International

economically, socially, culturally and biologically sustainable. The proposal also considers community self-determination to be an integral part of sustainable development, it suggests that:

> Local communities that wish to do so should prepare their own sustainable development strategies, defining their needs and aspirations, and expressing their own consensus on an appropriate balance among sectors and a desirable combination of large-scale and small-scale development.

The proposed Strategy is designed to meet several objectives including securing the community's environmental resource base, determining the community's economic future, ensuring development is sustainable, building a consensus on the economic future of the area, securing support from all sectors (including the provincial government, other affected communities and business interests) for the implementation of the Strategy, and identifying priority development and conservation actions needed to implement the Strategy. The Strategy will involve three major steps:

Union for the Conservation of Nature and Natural Resources (IUCN). According to Manning (1990) a conservation strategy is considered to be: "a way to set goals and action plans for the sustainable use of resources and the environment, using broad-scale consensus and comprehensive consultations...[they] should become a vision for the future environment, economy and society for Canada and its regions within a global context."

The World Conservation Strategy (IUCN 1980) identified three broad goals for the conservation of the world's resources 1) the maintenance of essential ecological processes and life support systems; 2) preservation of genetic diversity; and 3)sustainable utilization of species and ecosystems. These goals are intended to form the basis for determining the nature and extent of development within the area covered by the conservation strategy. Currently, conservation strategies have been initiated in 41 countries (Prescott-Allen 1989) primarily at the national and state or provincial level. Few of these have reached the implementation stage. Ideally, conservation strategies will be developed at the local, regional, and national levels and would complement one another as they work toward global goals.

1) assembling and analyzing base-line data on the community's economy, environment and values. This step involves completing studies on the major economic sectors and social and environmental concerns of the community including tourism, fisheries, forestry, mariculture, cultural heritage, community values, settlement planning, and biological diversity. (This step is essentially preparing a community State of the Environment report).

2) achieving a consensus on the future of the area.

3) reaching agreements with the Provincial government, neighbouring communities and industry on the actions to be taken which are to be outlined in the Strategy document.

It is intended that the Strategy will contain a description of the community's current economy, development goals, and values; identify the biological resources needed to support the economy and to improve the community's quality of life; present an integrated plan for conservation and development actions needed in each sector for sustainable development; provide options for resolving disagreements with the plan; and establish a mechanism for monitoring and evaluating the implementation of the plan.

The Strategy's education and consensus building component involves community meetings, and community review of the sectoral studies and drafts of the Strategy. A special council meeting was held to introduce the concepts of sustainable development. A public forum discussed the effectiveness of sustainable development strategies; experience with strategies in other communities; the scope, objectives, functions and main components of a strategy; and the main issues to be covered by the strategy. In addition, the process of developing the Strategy is being recorded to improve the usefulness of this project for other communities interested in community-led sustainable development planning.

Evaluation of Clayoquot Sound Strategy

This initiative does not explicitly challenge the existing world view. However, the holistic approach to problem solving and the emphasis on identifying community values (including the intrinsic value of natural resources) indicate that this initiative is consistent with the emerging world view. In addition, although the proposal does not recommend absolute limits to economic growth in the region, it does recognize that the future economic development of the region requires the maintenance of the biological productivity of the region's resources.

The process to prepare a Sustainable Development Strategy for the Clayoquot Sound region meets many of the substantive and procedural criteria of an ideal sustainable community initiative. The concerns outlined in the proposals for sectoral studies (outlined above) reflect an understanding of the need to adhere to most of the principles of ecological and social sustainability (achieving equity on a global basis is an obvious omission).

The Strategy proposal also meets the procedural criteria for a process of social change. It emphasizes education, community involvement in articulating the community's goals and desired future, and active community participation in developing and implementing the Strategy. In identifying and developing responses to all of these issue areas, the Strategy is also designed to provide an integrated framework for considering community concerns about the environment and economic development.

Global Action Plan for the Earth

The Global Action Plan for the Earth14 (GAP) is an international non-governmental organization. It has been developed as a means of co-ordinating local actions toward specific global environmental goals. The project has already established national teams in Australia, Canada, Great Britain, Netherlands, Norway, the Soviet Union, Sweden and the United States. It combines the strengths of mobilizing people at the local level, global co-ordination, and feedback mechanisms in order that individuals can see how their local actions are having a global impact.

The project has quantified key environmental issues (preserving climate, preserving diversity of life, reducing waste, water conservation, and population control) into measurable global goals to be achieved by the year 2000 (Appendix II). For instance, to preserve the diversity of life on a global basis requires that deforestation be reduced by 50% by the year 2000. This is translated into measureable goals in reducing waste at the personal, workplace and community levels. Similarly, other global goals will require changes at the individual and community level in energy and water use, transportation alternatives, waste management, consumer choices and political action.

With these global goals in place, communities around the world are encouraged to develop their own combination of solutions to meet these objectives. The project will collect data from participating communities on the extent to which they have met their goals. Results will be combined on a national and global basis and communicated back to the local level through various means (e.g. the media, environmental and service groups).

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14. Information on the Global Action Plan for the Earth is taken from the project outline obtained from: David Gershon, Global Action Plan for the Earth, 449A Route 28A, West Hurley, New York 12491, USA,

Evaluation of the Global Action Plan

The major strength of this project is its focus on mobilizing and empowering individuals at the local level through the creation of neighbourhood and workplace ecoteams to organize and implement changes. Leadership training programs have been designed to support individuals who will be acting as change agents in their own communities. The training programs are designed both to inform individuals on the state of the global and local environmental problems and to teach them how to apply skills of social empowerment (i.e. goals, feedback, communication, education) at the local level. A comprehensive guidebook has been prepared to identify specific actions that can be taken in the household to minimize waste, save energy etc. Additional guidebooks are being prepared to identify specific actions that can be taken in the workplace and community to meet the same broad global goals.

Despite its grassroots approach it appears that the project fails to challenge our existing world view. Many of the actions it proposes to deal with key environmental problems appear to be limited to making the status quo more efficient (e.g. improving energy, water, transportation efficiency). This weakness is probably due to the fact that the project requires measurable goals. Unfortunately, many of the more difficult choices we may have to make (e.g. making a transition to renewable energy sources and a steady state economy) can not easily be quantified. However, by placing local actions in the context of global environmental goals, the project encourages individuals to reevaluate their lifestyle choices in terms of their impact on the planet. Also, the focus on achieving specific measurable goals can be viewed as a strength if this project is considered primarily as a transitional effort toward sustainability rather than as an ideal model for a sustainable community.

A second weakness of the project is that it is limited to mobilizing efforts, primarily in the industrialized world, on critical environmental problems. It does not explicitly recognize the links between global environmental degradation, poverty and other social issues or provide any solutions for social problems. However, an expanded or modified matrix between global goals and individual, workplace and community action could include specific initiatives to address social issues.

The Global Action Plan for the Earth has tremendous potential as a means of empowering individuals to act at the local level. As a means of creating sustainanble communities, its success would be improved if it were used in combination with other initiatives that articulate and build a community consensus on the kind of future that we are working toward and mechanisms that provide a more integrated approach to solving both social and environmental problems on a local and global basis.

Community Responses to Global Warming - Toronto and Vancouver

Following the international conference on The Changing Atmosphere, the City of Toronto and the City of Vancouver established special committees to develop appropriate community responses to the issue of atmospheric change.

In Toronto, the primary mandate of the Special Advisory Committee on the Environment was to advise City Council on ways to meet the recommendation of the conference to reduce carbon dioxide emission by 20%, from 1988 levels, by the year 2005. The Committee proposed policy initiatives in each of three broad strategy areas to: 1) reduce air pollutant emissions, 2) recycle carbon emissions and 3) adapt locally to climatic change. Among the initiatives proposed are: reducing the energy intensity of the city's transportation (including enhancing public transit, promoting bicycling and walking),

developing a comprehensive energy conservation strategy (including energy audits and energy co-generation projects), financing reforestation projects in Central America and Southern Ontario, and expanding the shade tree planting program in the city.

In June 1990, the City of Vancouver Task Force on Atmospheric Change released its report Clouds of Change. The report recommends that the City of Vancouver should commit itself to three broad targets as a means of focussing the city's efforts to address atmospheric change: 1) a phase-out of all uses of products containing ozone depleting chemicals in the city by 1995, 2) immediate reductions in sulphur dioxide and methane emissions, and 3) a 20% reduction in 1988 levels of carbon dioxide emissions by 2005. The report also contains specific recommendations on institutional and substantive changes to transportation and traffic management, land use planning, and energy conservation, to achieve these targets. The report also provides many examples of actions that have been taken in other communities, including sample ordinances, to support their recommendations.

Evaluation of Community Global Warming Initiatives

Although there is a general agreement on the process of global warming, there is a great deal of uncertainty with respect to the timing and extent of the problem. This uncertainty has contributed to political inertia in higher levels of government on this issue. The Toronto and Vancouver initiatives are examples of how local governments can lead the way on serious global issues that higher levels of governments find too difficult to deal with. They are not, nor are they intended to be, comprehensive responses to creating sustainable communities. They do not address all the social principles that are part of the sustainability concept and they are limited in terms of proposing ways of changing people's

values or world view. They do, however, recognize the responsibility of the local community to act on global problems.

The Vancouver initiative is a more ecological or holistic approach to global warming since it provides recommendations to control all the compounds involved in the process of atmospheric change (e.g. carbon dioxide, ozone depleting substances, methane, sulphur dioxide). In comparison, the Toronto initiative concentrates its proposals primarily on controlling carbon dioxide emissions and increasing carbon dioxide absorption through reforestation. Ecological principles for sustainability demand integrated solutions to problems. Ecological problems, in particular, cannot be successfully dealt with in isolation from one another. For this reason alone, the impact of the Vancouver initiative (assuming the recommendations are approved and implemented) on the local environment will likely be more significant. In addition, the Vancouver initiative provides a greater range of recommendations on how the structure of the city could be transformed (through such things as energy-efficient land use policies, ecological development initiatives and residential intensification) in ways that would also make it more sustainable.

Both initiatives could be improved if they were developed and implemented within an overall process of change which would emphasize consensus building and integration with other initiatives towards creating a sustainable community. However, it is recognized that the potential threat from atmospheric change may be sufficient reason to demand immediate action to control emissions at the local level

CONCLUSIONS

The initiatives examined in this chapter represent a range of approaches to promoting the concept of sustainable communities. None of the initiatives meet all the rigorous criteria for substantive and procedural changes to create sustainable communities, developed from analysis in Chapters II, III, and IV. None explicitly recognize all of the principles for sustainability. However, each has very definite strengths that could be used in a comprehensive sustainable community strategy. The Canadian Healthy Communities Project, the Global Action Plan for Earth, and to a lesser extent sustainable development round tables or task forces, are valuable tools for mobilizing people at the local level to promote social change. Community sustainable development strategies and state of the environment reports (see also Appendix I) provide a logical, informed framework for community development that explicitly attempt to balance ecological, social and economic concerns. Other programs such as the Toronto and Vancouver global warming initiatives are designed to deal with specific aspects of the sustainable community concept. In isolation, none of these initiatives is sufficient to create a sustainable community. However, in combination, their potential is unlimited. An ideal model for creating sustainable communities, explored in the following chapter, integrates these initiatives into a framework of procedural components for social change and suggests where they might be used to implement the kinds of substantive changes required by the application of the principles for ecological and social sustainability.

CHAPTER VI - TOWARD SUSTAINABLE COMMUNITIES

The purpose of this chapter is to elaborate on the procedural and substantive changes that a community need to undertake to move toward sustainability. The recommended procedural components for change are supported by the social transformation theory examined in Chapter IV, and linked to specific models for sustainability, as examined in Chapter V. The recommended substantive changes are provided to illustrate the application of the Principles for Ecological and Social Sustainability (developed in Chapter III) to both existing and potentially new decision making sectors at the community level.

When we are dealing with the unknown much of what we learn will be by trial and error. The exact approach taken by each community will depend on the community's history, political and economic structure, and the severity of its environmental and social problems. Although the specific approaches to sustainability will likely differ between communities, the essential components in the process of change (consensus building, goal setting, integration, and implementation) and many of the substantive changes outlined in this chapter should be considered as a framework for directing the individual community's actions.

PROCEDURAL CHANGES TO CREATE SUSTAINABLE COMMUNITIES

The examination of social transformation theory and the evaluation of current models for sustainability indicate that there are four major components of a process of change: consensus building, goal setting, integration, and implementation. The characteristics of these components are explained below. Recommendations for procedural changes to create sustainable communities relate to each component.

Consensus Building

Before a community begins a process for change there must be a degree of consensus (either among the community leaders or the general population) on the need and direction of change. A process for consensus building requires mechanisms both for education and empowerment.

Education

Education is an essential component to consensus building. Members of the community must have a minimum of understanding of ecology and the current status of environmental and social problems to make informed decisions about the future of the community. Without a common understanding about the problems, there is a greater risk that members of the community will propose solutions that suit their own purposes rather than community goals. An example of this kind of situation is the current debate over the meaning of sustainable development. Since society has not yet reached a common understanding about environmental problems, the proposed solution (sustainable development) has been interpreted to mean anything from sustained environment to sustained economic growth.

At the community level, many currently proposed solutions to environmental problems, such as recycling, energy efficiency and green consumerism, require little in the way of adjusting our lifestyles or values. While it is good that communities commit themselves to these initiatives they should not be deflected from examining the world view that is the cause of these problems. If the environmental prognosis described in Chapter II is correct, the need for a new world view based on ecological values is essential to creating sustainable communities.

As indicated by social tranformation theories examined in Chapter IV (particularly the Rokeach Belief system, and Innovative learning), challenging our current world view is an essential element to supporting fundamental change. Consequently, communities must always challenge their assumptions about what kind of change is possible and desirable. They must also propose ways of translating ecological values into the basis for a more sustainable society.

In addition, support for fundamental social change will not occur until more people have a better understanding of the concept of sustainability. In order to diffuse new ideas about sustainability through the community, change agents and opinion leaders in a community must understand ecology, the problems with our current world view, and the potential benefits for society of changing to an ecological world view.

Empowerment

Innovative learning and Social mobilization theory suggest that social transformation toward sustainability needs to involve initiatives that are developed with extensive public involvement and discussion. For instance, an open format for political discussion provides the opportunity to educate while at the same time taking the necessary steps toward building a community consensus on the issues, and empowering people to take action. To be effective, the public involvement process must be a legitimate effort to incorporate the public's concerns into community decisions. In addition, mechanisms must be put in place to ensure that the general public is widely represented and the public involvement process is not "taken over" by special interest groups.

The Healthy Communities Project and a sustainable development round table or task force are examples of processes requiring active involvement to build a consensus in

the community on what actions should be taken to address environmental, social and economic problems. They also provide opportunities to develop networks between people involved in different occupations (such as government officials, business leaders, representatives from non-governmental organizations etc.) who are interested in working for the well-being of the planet and the betterment of the community. The Global Action Plan for the Earth, Turning 2000 Project, Waging Peace, and the Green City Program (See Appendix I for descriptions of the last three initiatives) take the concept of active public participation beyond involvement in decision making to include complete involvement in the implementation, monitoring and celebration of community transformation. It is this kind of involvement that will promote empowerment of individuals and eventually contribute to community self-reliance.

Consensus Building Recommendations

RECOMMENDATION 1

Objective: Education

A Community15 should support an education program on sustainability issues which could include:

a) information on environmental and social problems facing the community to be distributed through the local media;

b) ensuring that the local education system reflects an ecological perspective in all its teachings;

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15. All recommendations are made in generic terms to a community. Often the most appropriate institution for implementing these recommendations would be the community (or municipal) council. However, this does not have to be the case in all communities. Any group of empowered citizens could initiate, and potentially follow through, on implementing any of these recommendations.

c) participating in the Canadian Healthy Communities Project, or designing a similar program, to encourage lifestyle changes consistent with creating a more healthy community in human terms.

RECOMMENDATION 2

Objective: Empowerment

A Community should initiate the formation of a Sustainable Community Task Force (requiring extensive community involvement) to build a community consensus on the need and direction for change.

Considerations:

-the Task Force should be an independent organization, and act as an advisory body to the community council

-members on the Task Force should represent all sectors of the community (government, industry, non-governmental organizations, academics etc.). To maintain the credibility of the Task Force and its members, representatives should be chosen from nominations made by each sectors. Consideration should also be given to achieving appropriate gender and minority representation.

-the Task Force should operate on a consensus basis

-the Task Force's mandate should include a commitment to establish a public education program on sustainable community issues

-the Task Force should develop workshops for potential change agents and opinion leaders to educate them on the kinds of changes that are necessary and provide them with the tools to organize and empower other people. (Specific objectives: to diffuse new ideas throughout the community, and to empower individuals to act as catalysts for change. The Leadership training workshops of the Global Action Plan for the Earth could be used as a model for this type of seminar).

Goal Setting

As suggested by Innovative learning theory, developing consensus on the direction of change can be aided by encouraging the community to participate in a process to anticipate a better future and to find ways of creating a healthy and sustainble community. A future workshop16 could be used by communities to develop community goals that articulate this desired future.

In theory, a future workshop would be a participatory process, enabling people to discuss community problems and to develop creative approaches to resolving them. It would involve representatives from all sectors of the community to ensure that all perspectives are considered. Open discussions about the future would allow the entire community to work co-operatively to understand the issues, to identify the barriers to change, to imagine how the community could be different (and better), and to explore alternatives which are appropriate to the community yet still address global concerns. A

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16. Dauncey (1988) describes five phases to a successful future workshop as follows:

1. Preparatory Phase: a briefing session held to inform people what the workshop will be about to prepare them for the nature of the discussion to follow.

2. Critique Phase: discussion of problems and frustrations.

3. Creative Phase: brainstorming ideas on how to deal with major problems identified in 2.

4. Implementation Phase: preparing plans to implement the most promising ideas from 3 and arranging a means for follow-up.

5. Action Phase: community action as a result of the workshop.

successful future workshop would require group leaders who are skilled facilitators and are familiar with the issues being discussed (Dauncey 1988).

Ideally, a new vision of the community would emerge from the workshop(s) which could be refined with the help of additional visioning exercises, art and essay contests or a survey questionnaire of community goals. The vision would continue to evolve over time as the community begins to implement its agenda for change.

A community could also refine its vision for the future by developing a set of guidelines or principles to define their understanding of sustainability as it applies to their community. Again, it is necessary for the community to have a reasonable understanding of ecology before it can make an informed consensus about ecological and social sustainability. Although the principles, as described in Chapter III, are not written in stone, there is a "bottom line" to the definition of sustainability which is determined by ecological realities. Consequently, in some instances it may be necessary to make a trade off between full community consensus in order to meet this "bottom line".

Goal Setting Recommendations

RECOMMENDATION 3

Objective: To establish a set of goals and a vision of a more healthy future for the community.

The Sustainable Community Task Force should initiate a broad-based community discussion to determine the major goals of the community and to develop guidelines or principles for ecological and social sustainability.

Considerations:

-a community goal setting process could include Future Workshops (described above)

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-the priority of individual principles for ecological and social sustainability may differ slightly in each community depending on their specific problems; however, the principles finally agreed on must be consistent with current ecological theory

Integration

While the community is developing a consensus on the need and direction of change, the community should assess the current status of the region's environmental and social health to identify and quantify the extent of specific problems. Following this, an integrated course of action needs to be developed and assessed according to guidelines for sustainability.

Assessing the Current State of the Environment

Although establishing a new vision for future of the community is essential for determining the general direction of change, the process of change must be firmly rooted in knowledge of the current reality. Developing an integrated approach to achieving this vision will require information on the range of problems affecting the community and a better understanding of how these problems are interrelated. Through the preparation of a community inventory or state of the environment report, communities will have baseline information from which they can 1) gain a better understanding of the impacts of development; 2) prioritize the problems which must be addressed; 3) design integrated approaches to interrelated problems; and, 4) measure the success (or failure) of community efforts. Care should be taken that the state of the environment report does not become a narrow data collection activity. The development of the report should be made part of the process to educate and build community networks, by incorporating input from all sectors

of the community on what they consider to be the most critical issues facing the community.

A community state of the environment report should measure the community's health in its broadest sense. It should include measures of the biophysical environment (air and water pollution, biodiversity, nutrient flows through the community, energy and resource consumption), social environment (unemployment, poverty, homeless, health care statistics) and economic environment (alternative GNP adjusted for social costs). This broad perspective is the approach taken in the State of the Environment Report for Canada (Bird and Rapport 1986) and seems to be part of the Regional Municipality of Waterloo's effort (see Appendix I). The initial collection of such varied data may be difficult. A variety of indicators is required to assess present conditions and future trends and to assess the positive and negative impacts of a shift to sustainable development. Unfortunately, data that are currently available are not always the most appropriate for a state of the environment report since they were collected for other purposes (primarily as part of economic statistics concerning quantity of resources). Over time new quality of life indicators will need to be developed and data collected for future inventories.

The most critical quality of life indicators for the community should be monitored regularly and reported in the local news media. In this way the entire community will become more aware of longer term trends in social and environmental degradation (and rehabilitation), and will be better able to assess the need for further change.

Co-ordinating Actions

Having completed a community state of the environment report, a community should initiate the development of an integrated strategy to focus and co-ordinate

sustainable community initiatives. Whether it is developed under the guise of a conservation strategy, sustainable development strategy or a green city program, a strategy would respond to the range of environmental and social concerns identified in the community state of the environment report. With all the issues identified, priorities could be set and the opportunities for combining responses to several issues could be examined. For the most critical problems, the sustainable community strategy would also set measurable goals and propose alternatives for achieving those goals.17

In addition to assessing current problems and proposing alternative courses of action, a successful sustainable community strategy must also have sufficient financial and political support, adequate public participation, demonstration projects and built-in mechanisms to monitor the success of implementing the strategy (Prescott-Allen 1989). Public participation in the development of a strategy is essential to continue the community building process, to educate the community on what can be accomplished, to ensure that a wide range of potential solutions are examined, and to promote support and compliance with the initiatives that are agreed upon.

Shifting to a sustainable community will require change from all levels and sectors of society. Past experience with grand Master Plans indicates that such a change cannot successfully be orchestrated using a "top down" approach (Friedman 1987). However, creating a sustainable community still requires co-ordination of the efforts of all members of the community working in their own ways, within their own sphere of influence toward a common goal.

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17. Although not prepared in the context of a comprehensive strategy, the Toronto and Vancouver responses to global warming and the Global Action Plan for the Earth are good examples of solutions to priority environmental problems that are based on attaining measurable goals.

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A sustainable community strategy is an important tool for creating social change providing it is based on a consensus about the future of the community. It is also important for its ability to propose integrated solutions to community social and environmental problems. This latter characteristic demands that the strategy be broad in its approach to the environment and development. There is a danger that communities may narrow the concerns of the strategy to the those issues which are within the direct control of the local government or to environmental problems that have the most immediate impact on the community. A narrowly focused strategy would both limit the ability of the community to deal with the fundamental causes of environmental and social problems, and underestimate the tremendous potential for local action to contribute to global concerns. In the extreme it could also lead to action taken at the expense of other communities.

Integration Recommendations

RECOMMENDATION 4

Objective: To establish the institutional means to monitor the state of the environment

A Community Council should establish an independent Community Environmental Protection Agency to collect data on the state of the local environment and to enforce community environmental by-laws.

Comments:

-similar agencies established at the provincial and national levels do not have the funding or personnel to monitor and enforce environmental protection in all communities.

RECOMMENDATION 5

Objective: To assess the state of the local environment

A Community Council (in conjunction with the Community Environmental Protection Agency) should undertake an annual assessment of the community's social and environmental health in the form of a state of the environment report.

Comments:

-refer to existing models of State of the Environment reporting such as the Regional Municipality of Waterloo and the Burnaby initiatives (See Appendix I)

RECOMMENDATION 6

Objective: To establish an institutional mechanism for determining the specific actions a community should take.

A Sustainable Community Task Force should establish Sectoral Task Forces to build a consensus on how the principles for sustainability should be applied to community activities; to identify barriers to change; and to propose appropriate legislation to implement change.

Considerations:

-principles should be applied to all sectors of the community (government, business, individuals ets.)

RECOMMENDATION 7

Objective: To establish a process for integrating actions

A Community Council (in conjunction with the Sustainable Community Task Force and the Community Environmental Protection Agency) should initiate the preparation of a sustainable community strategy based on the community's principles for ecological and social sustainability.

Comments:

-refer to existing integration models including the Clayoquot Sound Sustainable Development Strategy, the San Francisco Green City Program, and the Burnaby Sustainable Economic Strategy (See Chapter V and Appendix I).

Implementation

The most important aspect of a sustainable community strategy is the implementation of its proposals. Even with adequate public support developed during the preparation of the strategy, problems will likely occur in the implementation stage if specific goals have not been set (or are not monitored) or responsiblity for action is not assigned to specific persons or sectors. Monitoring of implementation efforts could be achieved through environmental audits or the preparation of yearly state of the environment reports. Planned follow up has the additional advantage of making the implementation process responsive to unexpected environmental or social impacts of change. Monitoring is also recommended due to the experimental nature of many of the initiatives that will be undertaken. Successful initiatives should be celebrated and replicated in other communities. Unsuccessful initiatives will need to be discarded or remodelled.

As with the development of the strategy, implementation requires the involvement of the entire community. Each sector (including government, business, non-governmental organizations, and individuals) should be given some responsibility for meeting the overall community goals. Community efforts that are already underway should be recognized and built into the process of change. Efforts should be made to integrate local efforts with initiatives occuring in other communities and at the provincial, national and global levels. Ultimately, creating sustainable communities will need to be a co-operative effort.

RECOMMENDATION 8

Objective: To monitor the impact of change on the community

A Community Council (in conjunction with the Community Environmental Protection Agency) should monitor the impact of sustainable community initiatives on the local environment and revise action plans in light of new trends.

Considerations:

-monitoring of the community's overall environmental and social health could be achieved through the preparation of annual (or monthly) state of the environment reports

RECOMMENDATION 9

Objective: To implement substantive changes

The Community Council should approve the necessary legislative and policy changes to implement the recommendations of the Sustainable Community and Sectoral Task Forces.

Considerations:

-these recommendations should be similar to the actions outlined below concerning Land Use Planning, Economic Development, Waste Management, Resource Use, Transportation etc.

RECOMMENDATION 10

Objective: To maintain community support for change

The Community Council should ensure that the community is actively involved in implementing and monitoring changes.

Considerations:

-set measurable goals for each sector of the community based on the community's overall goals. Include individual citizens and non-governmental organizations in monitoring programs.

SUBSTANTIVE CHANGES TO CREATE SUSTAINABLE COMMUNITIES

Achieving environmental and social sustainability requires that sustainable community strategies deal with a wide range of community functions, many of which were previously planned and implemented in isolation from one another, within sectoral agencies, and with little consideration of their environmental impact. To design integrated solutions to community problems, a sustainable community strategy should consider all community functions and decision-making in terms of the principles of ecological and social sustainability. Under this scheme, community governments would need to establish new committees and/or departments to co-ordinate responses to specific global issues, liaise with other levels of government and other communities working on similar initiatives, monitor environmental health and enforce environmental policies. In established agencies and departments, such as economic development and parks management, policies and programs would need to be assessed and changed to meet sustainability principles. The following substantive recommendations are based on the consistent application of the principles for ecological and social sustainability (as outlined in Chapter III and summarized below) to major community decision making sectors: the community council, a newly established community environmental protection agency, land use planning, economic development, waste management, energy management, water management, transportation, finance and parks management.

Summary of Sustainability Principles

Principles for ecological sustainability

      1) Preserving Biological Diversity

      2) Maintaining the productive capacity of essential ecological processes and life support systems.

      3) Integrating urban functions with nutrient cycles and balancing nutrient budgets.

      4) Minimizing energy and resource consumption.

      5) Achieving dynamic equilibrium between human and natural systems. Responding to fluctuations in the natural environment (i.e. maintaining flexibility, monitoring for unexpected impacts).

Principles for social sustainability

      6) Developing values for ecological and social sustainability.

      7) Meeting basic human needs (food, water, shelter, employment)

      8) Achieving equity (locally and globally)

      9) Promoting self-determination

      10) Creating a sustainable economy

Application of Sustainability Principles

Recommendations for Community Councils

Community councils should establish a special committee to be responsible for co-ordinating local action on emerging global issues and for liaising with other levels of government working on similar initiatives.

To address critical global concerns and to co-ordinate efforts with other levels of government, community councils should consider the following options which are consistent with the principles of ecological and social sustainability:

PRINCIPLE	OPTIONS TO CONSIDER
1	-Twin with communities in the developing world such as Brazil and Indonesia to share resources and to promote local economic development initiatives that will protect tropical rainforests (the world's most biologically diverse ecosystems).
2	-Initiate a local response to global warming which could include reforestation initiatives, restrictions on automobile use and increased public transport. Build on existing initiatives in Toronto and Vancouver. -Demand a similar response from higher levels of government.
3	-Lobby senior governments to set higher emission standards for emissions which contribute to acid rain and global warming.
4	-Initiate buy local campaigns to provide local employment and to reduce energy consumption related to long distance transportation of goods. -Initiate a lifestyle campaign (less is better) to promote a voluntary reduction in material consumption.
5	-In the face of scientific uncertainty, be prepared to make difficult decisions based on value judgements.
6	-Support a process for developing a consensus on the community's goals (See Procedural Recommendation 3). -Work with local media and schools to discuss and teach ecological values.
7,8	-Assess the extent to which basic needs are not being met in the community and take appropriate action. -Establish a local fund for international aid. Involve local people in international aid programs. Participate in the Federation of Canadian Municipalities International Programs. -Reduce per capita material consumption in the community through establishing exchange programs to ensure materials are reused within the community.

9   ·-Establish a Sustainable Community Task Force with members representing all
        sectors of the community.
        -Establish a committee to integrate the community's sustainable development
        initiatives.

10   -Link with other communities to develop local economic development initiatives.

Communities need to establish their own environmental protection agencies as recommended under the above procedural recommendations.

PRINCIPLE	OPTIONS TO CONSIDER
1	-Develop measures to monitor biological diversity. -Lead in the preparation of an inventory of ecological resources in the community.
2	-Estimate the carrying capacity of the region and work with community planners and economic development personnel to translate this into practical guidelines.
3	-Identify causes of disruptions in local nutrient cycles. Propose corrective measures. -Develop measures to monitor the balance of resource flows through the community.
4	-Collect data and monitor trends in energy and resource consumption in all sectors of the community.
5	-Monitor impacts of sustainable development demonstration projects. -Provide and independent review of environmental impact assessments for all major local projects. -Collect information on initiatives occuring in other communities. -Lead in the preparation of an annual community state of the environment reports to monitor changes in local and global ecosystems. -Participate in the development of a sustainable community strategy.
6	-Advise other agencies, businesses, and local officials of ways in which their activities can be made sustainable. -Establish educational programs to promote awareness of local environment and knowledge of ecology.
7,8	-Social agencies should monitor key indicators of social sustainability in the community (e.g. health statistics, unemployment, poverty, homeless).
9	-Involve community organizations in monitoring local ecological indicators and reporting violations of ecological legislation.
10	-Identify economic benefits obtained through shifting to a sustainable economy.

Recommendations for Land Use Planning

PRINCIPLE   **OPTIONS TO CONSIDER**

1   -Protect unique ecosystems from development through zoning, creating urban parks
     or private and public land trusts.

2   -Propose zoning ordinances that help to limit population and industrial growth to
     the region's carrying capacity.
     -Protect examples of complete ecosystems, especially the most biologically
     productive, from development (e.g. wetlands, estuaries) through zoning, wildlife
     corridor protection by-laws, stream corridor and wetlands ordinances (see Mantell
     et. al. 1990).

3   -Prepare community land use plans from a bioregional perspective (integrating
     rural and urban concerns).
     -Zone land within each neighbourhood for use as community gardens to encourage
     composting within the city
     -Protect best agricultural land from urban sprawl through zoning, development
     guidance systems, or purchase of development rights program (see Mantell et. al.
     1990).

4   -Integrate residential, commercial and industrial land uses in order to minimize the
     need for commuting.

5   -Adjust the land use plan in response to adverse impacts identified in annual state
     of the environment reports

6   -Prepare a land stewardship policy to guide permitted development

7   -Ensure land use plan provides for adequate amounts of land for affordable
     housing.

8   -Share expertise in land use planning with a community in a developing nation.

9   -Develop plans from a process of community consensus building (such as the
     Sustainable Community Task Force recommended above).

10   -Provide land for sustainable economic activities. Restrict land availability to non-
     sustainable activities.

Recommendations for Economic Development

Communities often look to higher levels of government for economic development assistance in the form of government subsidies and loans. The following recommendations encourage communities to take control of their own economic development while ensuring that the options they choose are also environmentally and socially sustainable.

PRINCIPLE   **OPTIONS TO CONSIDER**

1   -Provide property tax breaks to economic enterprises that preserve biological diversity (e.g. organic farming, selective logging of forests, harvesting fruits of native species, tourism).

2   -Provide subsidies to economic activities that are based on the sustainable use of natural resources.
-Locate industrial activities away from critical environmental resources (e.g water, agricultural land)
-Limit industrial growth to the carrying capacity of the region (limit is dependent on the technology currently available).
-Tax industry based on the type of hazardous material generated.

4   -Assess local business operations according to sustainability criteria (e.g. energy efficiency, recycling of by-products, using appropriate technology).
-Tax industry for the volume of waste generated.

5   -Monitor impact of economic activity on the biophysical and social environment.
-Incorporate negative feedback mechanisms (e.g. physical quality of life index) into development strategies.

6   -Encourage economic development in quality of life activities including education, arts, recreation activities such as hiking, canoeing, bicycling). (See Appendi I - Burnaby Economic Development Strategy as an example)

7   -Focus economic development initiatives to provide food, shelter, clothing, education to the entire community.

8   -Commit aid to communities in the developing world in the form of shared knowledge, expertise, technology, and production of essential goods.

9   -Provide subsidies or low interest loans to support local economic development initiatives (i.e. those that are locally controlled, promote local self-reliance and are environmentally and socially sustainable).
-Work with other levels of government toward gaining greater control over local resources (e.g. forests, minerals) possibly through co-managment agreements.

10   -Provide business permits only to those economic activities that make a positive net contribution (economic benefits exceed social and environmental costs) to the community.

Recommendations for Waste Management

Since communities are generally responsible for their own waste management, the following options could be implemented without support from other levels of government.

PRINCIPLE   **OPTIONS TO CONSIDER**

1   -Create sewage lagoons as a natural way to filter sewage and provide wildlife habitat.

2   -Institute by-laws (or enforce provincial guidelines) to achieve zero discharge of non-biodegradable toxic waste.
      -Set limits on the release of biodegradable waste into the environment up to the ecological capacity of the system to recycle waste.
      -Rehabilitate ecosystems damaged by toxic wastes.
      -Where the use of landfills can not be eliminated, zone their location away from aquatic environments.

3   -Install waste treatment facilities to recycle municipal sewage.
      -Establish community composting programs.
      -Restrict the incineration of waste for energy to waste that does not produce toxic by-products when burned (e.g. wood, paper). This will require source separation of waste. Plant additional trees to recycle the carbon dioxide produced from this process.

4   -Institute recycling programs for the entire community (residential and industrial sources).
      -Establish programs to facilitate the reuse and repair of products.

5   -Monitor the long-term impacts of hazardous waste already released into the environment.

6   -Establish a conservation awareness campaign.

7   -Utlilize resources made available through recycling and reuse programs to provide for basic needs (shelter, clothing).

8   -Site recycling depots, landfills or incinerators (for waste that cannot be eliminated) within the region that produced the waste.
      -Prohibit the shipment of hazardous waste outside of the community (especially ensure that it is not being shipped to developing countries for disposal).

9   -Levy a charge to households and industries for the volume of garbage they produce weekly, making individuals responsible for reducing waste and participating in community recycling programs.

During the transition toward sustainable sources of energy, communities will need to negotiate with provincial utilities to implement some of the following options concerning energy use.

PRINCIPLE   **OPTIONS TO CONSIDER**

1   -Reduce reliance on energy sources that reduce biological diversity (e.g. coal produces acid rain which destroys marine life) by developing locally-generated alternative sources of energy.

2   -Reduce consumption of energy from non-sustainable sources (e.g. coal, nuclear, large scale hydro electric projects) through conservation efforts.
     -Set specific targets for a reduction in the consumption of energy produced from fossil fuel combustion in response to global warming.

3   -Develop alternative sources of energy that are compatible with local nutrient cycles such as locally generated biogas and solar energy.

4   -Include energy conservation requirements in local building standards.
     -Perform energy audits throughout the community.

5   -Adjust local energy policy for results of monitoring programs.

6   -Implement a user pays approach to excessive energy use (i.e. institute an increasing rate scale vs. the volume discount approach to energy use).
     -Initiate a local energy conservation education program.

7   -Ensure a minimum level of energy is available to everyone in the community.

8   -Ensure a range of energy alternatives is equally available throughout the community.
     -Share expertise on locally generated power (using appropriate technology) with communities in the developing world.

9   -Provide property tax reductions to households, and businesses that produce their own power.

10   -Institute an energy consumption tax on economic activities to encourage energy conservation.

Communities should work to ensure that the local water management authority incorporates the following recommendations into their operations.

PRINCIPLE   **OPTIONS TO CONSIDER**

1,2   -Institute by-laws to prohibit the discharge of hazardous chemicals into the water (e.g. control access to municipal sewage system, control atmospheric emissions, promote organic agriculture to eliminate use of chemical pesticides and fertilizers).
-Identify sources of buried toxic wastes and contain leaching into ground water.

3   -Utilize the capacity of forests and wetlands to filter water. This will also make the community aware of the importance of forests and wetlands to the overall health of the community.

4   -Meter water and charge an increasing rate for higher consumption.
-Institute a by-law requiring the collection of rain water for non-drinking purposes (e.g. watering plants, lawns)
-Develop a program to make water conserving devices available to households and industries.

5   -Continue to monitor long-term effects of toxic pollutants in the water on the health of human and other species.

6   -Establish a community festival to celebrate the life giving qualities of water.

7   -Ensure an adequate supply of clean water is available and distributed to meet the basic requirements of life to all community members.

8   -Learn additional techniques of water conservation from water scarce countries.
-Share knowledge of the impact of municipal and industrial pollutants with developing countries to help protect their ground water.

Recommendations for Transportation

Since communities are generally responsible for developing local transportation, the following options could be implemented without support from other levels of government.

PRINCIPLE   **OPTIONS TO CONSIDER**

1   -Plan transportation routes to avoid sensitive ecological areas.
      -Prioritize transportation options according to their impact on the physical environment.

2   -Set vehicle licence fees according to engine size and type. Lower fees for those that are the least polluting and energy consumptive.
      -Set local goals for reducing carbon dioxide and nitrogen oxide emissions caused from transportation sources.

3   -Tax users for the amount of emissions they produce according to their choice of transportation. Funds should be used to plant trees to recycle the carbon dioxide produced.

4   -Encourage the use of energy efficient transportation alternatives such as bicycles and walking.
      -Work with planners to minimize the need for commuting (integrate land use, extending bicycle and walking paths).

5   -Monitor impact of transportation alternatives in terms of changes in atmospheric emissions to determine the best combination of transportation options.

7   -Improve transportation system to provide equal access to employment opportunities.

8   -Ensure the cost of transportation alternatives is equitable. Increase subsidies to mass transportation through the reduction of subsidies to the automobile (e.g. road repairs and improvements).

10   -Encourage industries to organize employee carpooling programs.
      -Require industries located in remote areas to provide access to public transportation for their employees (e.g. supply buses before and after work to link with public transportation terminals).
      -Zone residential areas closer to employment centres.

The following recommendations are provided as ways a community may consider to raise or reallocate funds to help finance a transition toward sustainability.

PRINCIPLE   **OPTIONS TO CONSIDER**

1-5   -Provide incentives to owners of ecologically sensitive areas to protect them from development.

-Assess property taxes on the basis of the ecological sustainability of the land use (e.g. land used for non-sustainable industrial development taxed at a higher rate than land left in its natural state, high density residential taxed at a lower rate than low density).

-Charge individuals and industries for waste removal based on volume (i.e. number of bags).

-Provide property tax incentives for infill and higher density development (to protect remaining farmland, wetlands etc).

-Increase subsidies to public transit.

-Increase parking rates (and property taxes to parking lot owners) to discourage automobile use.

6   -Place economic disincentives on local advertising which promotes excessive or unnecessary consumption.

7   -Increase funding to social services (i.e. providing food, clothing shelter) to the community.

8   -Levy a tax on goods imported from developing countries. Proceeds used for international aid.

10   -Increase business taxes to non-sustainable activites. Use funds to finance new sustainable activities or to help industries become sustainable.

Recommendations for Parks Management

Since communities are generally responsible for developing and maintaining local parks, the following options could be implemented without support from other levels of government.

PRINCIPLE   **OPTIONS TO CONSIDER**

1   -Protect unique natural ecosystems as urban wilderness parks.
        -Reintroduce wildlife species to local wilderness parks.
        -Plant native species in landscaped areas.
        -Avoid monocultures in green spaces.
        -Use natural predators to control pest populations. Eliminate the use of chemical herbicides and pesticides.

2   -Rehabilitate damaged ecosystems.
        -Plant replacement trees in parks for those lost in developed areas.

3   -Plan location of parks and greenbelts to utilize the capability of protected forests and wetlands to act as natural filter systems.
        -Permit the harvesting of berries, nuts, herbs etc. in local parks for food.

4   -Promote recreational opportunities that minimize energy use (e.g. sailing or canoeing vs. power boating).

5   -Allow the natural process of succession take place in urban wilderness parks.

7   -Ensure the quantity, quality and accessibility of urban parks is sufficient for the mental well-being of the people.

6   -Establish educational programs in local wilderness parks to promote understanding of ecology.

8   -Ensure that parks and greenspaces are established equitably throughout the community (i.e. in high and low income areas).

9   -Encourage local organizations to take responsiblity for stewardship of the parks.

10   -Permit economic activities based on the sustainable use of park resources (e.g. harvesting of the fruits of the forest).

SUMMARY

Creating sustainable communities is as much a process of consensus building and empowerment as it is a physical conversion of communities. A process for change should contain mechanisms for each of the essential components: consensus building, goal setting, integration and implementation. Consensus building mechanisms should be educational and require active participation by community members. Goal setting mechanims should encourage the community to envision and create a future that is fundamentally different. Communities should begin to articulate this vision into principles for sustainable community development. Integrating mechanisms should include both a process to assess the seriousness of environmental and social problems affecting the community and a means to provide integrated solutions. Although the specific approach to creating a sustainable community must be determined locally, community actions must be co-ordinated with actions taken in other communities and by other levels of government. Implementation mechanisms should involve the community and include monitoring the impact of actions taken by the community. Finally, substantive changes should be developed from the application of the principles of ecological and social sustainability to all sectors of community decision making.

CHAPTER VII - IMPLICATIONS FOR PLANNERS

ROLE OF THE PLANNER

Periods of social transformation demand that planners expand both their range of skills and the roles in which they apply those skills. According to Friedman (1987), the most effective position for planners during periods of fundamental social change is acting as radical planners in the social mobilization planning tradition. Radical planners generally work outside the dominant social structures to empower individuals, groups or communities to engage in transformative action that will create the future they want. They could encourage people to take responsibility for community environmental and social problems by establishing a community sustainable development round table or task force, creating community land trusts or community development corporations; participating in the Global Action Plan for the Earth; or developing an initiative of their own creation. Planners can also work to build networks or coalitions of community groups to improve their effectivenss as a social movement. In these roles, planners are effectively working as change agents sowing the seeds for fundamental change.

Planners can also play significant roles within mainstream institutions to facilitate access of community organizations to the existing power structure and to promote moderate institutional change. As part of the local or regional bureaucracy, planners could promote the need for, and participate in establishing, a healthy community project, sustainable community strategy, or state of the environment report. Planners could ensure that the process to develop them is sufficiently open to serve both as a forum for community education and as an opportunity for the community to determine their own future. Planners could also act as mediators to bring diverse interests to a consensus on

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the problems or on appropriate future action. The planner's substantive knowledge in ecology and planning will be essential to helping the community to define principles for ecological and social sustainability. The planner's integrative skills and substantive knowledge could be used to synthesize the results of community goal setting exercises into a statement of the community's plans which would then form the basis for future legislation and policy or program guidelines. In this role, the planner is both a facilitator and a source of information or technical expertise.

Regardless of the role, planners must have an understanding of the global historical context in which their actions are taking place and the skills to enable them to effectively carry through a plan for change. To understand the global context of creating a sustainable community, planners must have substantive knowledge in ecology, sociology, philosophy and economics. They must also understand the historical roots of current environmental and social problems. Planners need to be aware of the interrelationships between social and environmental problems to guide the development of integrated solutions. Due to the speed with which global problems are evolving, planners must also stay informed of new data which may change their assessment of the seriousness of these problems.

Planners working to mobilize people must be effective communicators and skilled in group process techniques such as facilitating. As mediators, planners will need to be skilled in techniques for conflict resolution. Planners must also be capable of focusing action to overcome resistance to change. They must have the ability to design effective strategies utilizing relevant technical information, recognizing the barriers to change and suggesting ways to overcome them and carefully monitoring the impact of any action

taken (Friedman 1987). They must also be able to analyze conflicting data and opinions and synthesize the results to form an opinion on the appropriate course(s) of action.

SUGGESTIONS FOR FUTURE RESEARCH

As the concept of a sustainable community is new, the potential for further research is unlimited. This thesis has touched on many trends (e.g. global warming, population, accelerated urbanization, globalization of trade) that indicate a need for developing new approaches to designing communities. Further research is needed to monitor the full impact of these trends on community development both in the industrial and developing world.

The ecological world view presented in Chapter II was synthesized from work that is already in process. As this work continues to be refined it should be debated more widely to test its validity and to make it more accessible to those in the best position to influence society's values (e.g. educators, opinion leaders, media). A better understanding of the process of social transformation would also be useful to determine the most effective ways of influencing the direction and speed of change.

The ecological and social sustainability principles very broadly developed in Chapter III require further refinement to ensure that the list is comprehensive and to make them more useful as guidelines for community planners. Additional work is needed to better reflect the spiritual dimension of the sustainable community concept in these principles.

A valuable source of knowledge on this subject will come from examining the experiences of communities that are committed to shifting toward sustainability. Some of these communities are participating in the inititives examined in Chapter V (and outlined

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in Appendix I). Unfortunately these initiatives are still in the early stages of development and are therefore difficult to evaluate for success at this point in time. Follow up studies should be performed on these approaches to make a more informed assessment of their impact on sustainable community development. Part of this assessment should include an analysis of the costs and benefits to the communities and to society in general. Although sustainability principles and specific initiatives such as a sustainable community strategy can be used to transform a community, each alternative must be analyzed to ensure that when all the impacts are considered it is the most appropriate response to the problems in that community.

CHAPTER VIII - SUMMARY

The primary purpose of this thesis was to examine ways of creating sustainable communities. However, in order to address this topic it was necessary to first examine why communities need to change and to identify what a sustainable community would look like.

This thesis began from the premise that the environmental and social problems that the world is currently facing are a result of the fact that we are operating under certain assumptions about reality (which form our reductionist world view) that we are now discovering to be false. Given this premise it follows that a fundamental shift in world view is required to effectively deal with our changing world. The analysis in Chapter II indicates that much work is already being done to articulate a new ecological world view that is based on our new understanding of the complex and dynamic relationships at work in the natural world and our reevaluation of the place of humanity within life on Earth.

Chapter III developed principles for ecological and social sustainability based on the major characteristics of the emerging ecological world view and examined to ensure that they are consistent with current ecological and social theory. This analysis, although limited in scope, should provide a starting point for community planners to assess the desirability of development options. The principles for ecological and social sustainability based on this new world view help to articulate a vision of a potential human community that is responsible, caring, empowered, healthy, and most importantly, in balance with nature.

Given the need for fundamental change, I examined several theories of social transformation to identify the critical elements to social change. These theories support

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the view that the impetus for fundamental change must come from the grassroots and that any effort to build a sustainable community must concentrate much of its energy on changing an individual's values and mobilizing people to create their own solutions. Individuals can then work both within our existing institutions and outside of them to promote change. Also, the more individuals one is able to convince of the need for change (especially those in positions of influence) the more likely one will be able to effect change.

The review of sustainable community initiatives in Chapter V indicates, not surprisingly, that none meet the rather ambitious set of criteria developed from the previous analysis of a new world view, principles for sustainability and theory of social transformation. The purpose of this review was not to condemn these early initiatives for being inadequate to meeting the goals of a sustainable community but to identify ways in which they could be improved. It was also an attempt to articulate some of the concerns that should be considered whenever a new sustainable community initiative is undertaken.

Finally, Chapter VI attempted to bring all of these diverse ideas together to develop a model for a process of social change at the community level, and to provide specific examples of the kinds of substantive changes required by the principles of ecological and social sustainability to create sustainable communities. The process for change emphasizes both the need to empower people and to build a sense of mutual co-operation to create a new vision for the community. It recognizes that community transformation must be an informed process. There must be a general understanding of the current state of the community and support for the goals the community is attempting to achieve. The community must also develop some form of integrated strategy to ensure that all problems are identified, prioritized and community action co-ordinated. Such a process must not be an attempt at "top-down" planning for the environment. It must be a

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process of education and an opportunity for the entire community to become involved in determining its future, and taking responsibility for ensuring that solutions are found for all problems whether they are local or global in origin.

A final conclusion that can be made from this thesis is that a great deal more work needs to be done in developing the sustainable community concept and in experimenting with its implementation. It is hoped that this thesis has shed some light into this emerging area.

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APPENDIX I - ADDITIONAL SUSTAINABLE COMMUNITY INITIATIVES

Sustainable Development Round Table: Peterborough

Contact:

Mayor Sylvia Sutherland
Office of the Mayor
The Corporation of the City of Peterborough
City Hall

The Peterborough Sustainable Development Committee is a municipal round table formed in 1988 in response to the challenge of the World Commission on Environment and Development report Our Common Future (1987) and the recommendation of the Report of the National Task Force on Environment and Economy (NTFEE 1987) regarding the formation of Round Tables on Environment and Economy at the federal and provincial levels. The Round Tables are intended to be a new process of consultation designed to work toward consensus between representatives from all sectors of society on ways of integrating environment and economic concerns in all levels of decision making. In 1990, the Federation of Canadian Municipalities (FCM) agreed to support the creation of Municipal Round Tables as one mechanism for addressing environmental issues at the local level. The FCM considers Round Tables to be a means of engaging public interest, involving the community in producing workable plans for action on the environment, and building consensus for their implementation. The role of the Round Table will vary depending on the needs of the community. Some possible activities for a Round Table, recommended by the FCM, include: acting as a community advisory body on

environmental issues, holding public forums to hear community concerns, developing sustainable development principles appropriate for the community, initiating a municipal sustainable development plan, developing networks with other Round Tables, and working with community groups to establish sustainable development projects and programs.

The Peterborough Sustainable Development Committee consists of representatives from local and provincial government, industry, non-governmental organizations and the academic and religious communities. The Committee has been given the mandate to provide a model for action on environmental issues at the local level and it acts as an advisory body to the Peterborough City Council on issues relating to sustainable development. To date, the Committee has formed several subcommittees to deal with 1) the specific problems encountered by business and industry, 2) special projects, 3)community liaison and education, and 4) planning and policy implications of sustainable development. In terms of output, the Business and industry subcommittee have produced a summary of general principles for environmentally responsible industry which has been distributed to all local industries to encourage voluntary action.

The ability for a round table to challenge the existing world view will depend on the mind set of the members and the extent to which the group debates the meaning of sustainable development, develops principles for sustainability and determines the implications for the community. If the round table has several members that believe fundamental change is necessary, the recommendations of the group are likely to reflect this. It is not clear at this time whether the initiatives of the Peterborough Round Table will challenge the current world view or reflect all of the principles for ecological and social sustainability.

A municipal sustainable development round table is a potentially valuable tool for promoting social change by developing consensus on the need for and direction of change in the community. Support for the round table will depend on whether its members represent a broad range of interests, sectors, and values, and the nature of its involvement with the community. The Peterborough Round Table has a wide range of sectors represented and has established a community liaison and education subcommittee which will help to generate support within the community both for the activities of the Round Table and for the concept of sustainable development.

Economic Development Strategy - Burnaby, British Columbia

Contact:

The Corporation of the District of Burnaby
4949 Canada Way
Burnaby, British Columbia
V5G 1M2

Economic Development Strategy:
Phil Sanderson
Economic Development Coordinator

Healthy Communities:
John Foster

State of the Environment Report:
Sarah Groves

The District of Burnaby is involved in several initiatives to promote sustainable development: the Canadian Healthy Communities Project, the incorporation of sustainable development principles into their Economic Development Strategy, and the preparation of a State of the Environment Report. Although each has been undertaken as a separate project, in combination they could be considered to be part of an overall sustainable development strategy.

The district's 1990 Economic Development Strategy is designed to attract economic activities that provide both financial and social benefits, make wise use of the community's environmental and human resources and do not threaten the environment. To this end the strategy identifies 15 areas for economic development: education, light industrial and high technology, local economic development initiatives, not-for-profit organizations, film and video industry, the arts, tourism, sports and recreation, regional headquarters for business and government, retail and service, health, housing and services for seniors, agriculture, and making existing industry more environmentally sustainable. All of these areas are

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means of providing employment opportunities while maintaining (and potentially improving) the quality of life in the community.

While the strategy was not prepared with specific knowledge of the current state of the community's environment, the direction for economic development is certainly in keeping with many ecological and social sustainability principles as indicated by the emphasis on development which is not material intensive. Detailed principles of sustainability are not presented in the strategy other than in a general understanding that sustainable development is less harmful to the environment and improves the quality of life.

The strategy was developed with a significant amount of community participation. An Economic Development Advisory Committee was established with members representing business, education, labour, environment, the arts, social services and agriculture to ensure that a broad spectrum of community interests were included in the strategy. The importance of developing this network of community interests was recognized as part of the lasting benefits of the strategy development process. Further public input was solicited through a series of open houses, a round table discussion and a community television broadcast.

The strategy also calls for continual monitoring, through annual progress reports, to determine whether it is having the desired effects. A second initiative, a state of the environment report (SOER) for the community, will also help in monitoring the impact of the economic development strategy. Initial documents (May 1990) indicate that the SOER will concentrate on conducting an inventory of natural assets, identify key environmental issues and problems, develop environmental goals and an environmental action plan for the community. This initiative should help the community to identify the important

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ecological criteria for sustainable development. The SOER would need to be extended to include data on pertinant social indicators in order to monitor social sustainability.

The District of Burnaby is considering a "policy approach" to the Healthy Communities project as opposed to a "planning approach" which can require a heavy financial commitment to involve the entire community; or a "project approach" which would address only one or more issues on a non-comprehensive basis. A policy approach would improve decisions taken by the District by ensuring that the impacts on community health are adequately considered. Specific activities to be undertaken may include an education program for municipal councial and staff on healthy community concepts, preparation of health impact statements on municipal policies and practices, development of healthy community policies, and forming a healthy community advisory committee.

In combination, these initiatives represent a step toward sustainable community development. The Economic Development Strategy indicates a desire to build consensus on the future direction of the community. Continued community discussions should promote a greater shift in values and may generate support for fundamental social change. The SOER will provide the base data for assessing the effectiveness of this strategy and will raise awareness of local environmental issues. The community's involvement in the healthy community project, although limited in its approach, should help to ensure that social and environmental concerns become integral to all municipal decisions. Unfortunately, it is too early to assess the extent to which these initiatives will reflect the principles of ecological and social sustainability.

A Green City Program - San Francisco

Contact:

Planet Drum Foundation

The Green City Program (Berg et al 1989) was inititated by the non-governmental organization Planet Drum Foundation. The Foundation is best known for developing the concept of a bioregion and working with local organizations to find ways to live within the limits of their bioregion by promoting ecological sustainability, community self-determination and regional self-reliance. The Green City Program was developed from a series of community discussions centered around what was considered to be the key problem areas a city must address to become ecologically and socially sustainable. A manual has been produced from these discussions as a guide for organizers wishing to "Green" their communities. The manual provides specific ideas in the areas of transportation, energy, sustainable planning, bringing wildlife and plantlife back into the city, empowering neighbourhoods, creating socially responsible business and celebrating the uniqueness of where we live (our "life-place").

The Green City Program is designed as a blueprint for creating a sustainable community. It provides a focus and a means of co-ordinating all the individual activities that are already occurring through non-governmental organizations in the San Francisco area, and it identifies areas in which work still needs to be done. Although the examples and list of existing volunteer organizations are specific to the San Francisco area, the concepts outlined in the manual are easily transferable to any community.

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The Green City Program reflects many of the principles of a new ecological world view. The policy proposals consistently challenge basic assumptions about the nature of the modern city and provide new and exciting ways of changing our cities. It offers an integrated approach to dealing with urban ecological problems. Its strength is the simplicity with which it suggests practical solutions and specific actions for grassroots organizations rather than elaborating on the problems. Its major weakness is that it concentrates solely on local problems and local issues. It does not identify the need for communities to work with other communities and other levels of government to address the global environmental and social equity issues confronting us.

State of the Environment Report - Regional Municipality of Waterloo

Contact:

Clark Reichert

The Regional Municipality of Waterloo is currently involved in developing its second local state of the environment report. The mandate of the Ecological and Environmental Advisory Committee of the Regional Municipality of Waterloo (EEAC) requires that a state of the regional environment report be prepared every 4 to 5 years. This report is to "serve as a monitoring tool, and focus primarily upon natural environmental conditions, the utilization of natural resources and land, and the biophysical consequences of growth and development" (EEAC 1988). The report will provide quantitative and qualitative data on the environment; identify trends in key areas such as water resources, pollution abatement, waste management, agricultural and forest land management; and analyze the impact of these trends on the quality of life in the region. The report is intended to form the framework for the future direction of development in the region, identify emerging problems, and propose options for individual and community action.

A community-based approach and public input are considered to be key factors in determining the usefulness of the report and the acceptance of its findings. A local university (University of Waterloo) was involved in the process through the preparation of a report on the state of environment reporting at the local level which proposed a

methodology for the Region's initiative (Allen et al). To facilitate public input a Citizens Advisory Committee on Regional Quality of Life was established to meet with citizens and receive written briefs on their concerns about the quality of life (environmental, social and economic) in the region.

A state of the environment report will not, in itself, challenge the existing world view but it does offer the opportunity to assess the extent of the environmental problems the community is facing. It is not clear from the preliminary information on this project whether the focus on regional or local issues will mean that the global issues (e.g. global warming, poverty) will be ignored or considered to be strictly the concern of higher levels of government. The emphasis on public participation and the concern for quality of life above economic growth indicates that this may be a good tool for promoting a change in values which may eventually provide the support for fundamental social change. The public discussions initiated by the Citizens Advisory Committee indicates that the community is supportive of many of the principles of ecological and social sustainability; however, it is not clear whether these principles will be reflected in the final state of the environment report.

Turning 2000 Project

Contact:

Laurie Gourlay

Turning 2000 is a non-governmental organization project which encourages individuals to volunteer 12 hours a year for 30 years for the benefit of their own communities. The project emphasizes local action to establish healthy community environments according to global conservation and development principles. To assist in mobilizing at the grass roots level, the project provides a manual to organizers suggesting ways of getting community support, forming local associations, planning and implementing community programs, and fundraising. It also offers 2000 suggestions for specific local activities in the areas of education, planning and analysis, hands-on demonstration projects, and forming networks.

In addition, the project identifies three core projects which communities are encouraged to participate in: 1) Taking Inventory, 2) developing a Cross-Canada trail, and 3) developing an Urban/Community Conservation Strategy. The Taking Inventory project is similar to developing a community state of the environment report. It provides communities with the chance to become familiar with the current state of the local environment and to identify the opportunities and constraints to making changes. The inventory is not limited to ecological resources but would also identify local areas of cultural, historical and social value. The inventory would provide a valuable source of information for the subsequent development of an Urban Conservation Strategy. The

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Cross-Canada Trail is a project that would create a natural link between communities while at the same time providing protection to endangered natural areas.

Turning 2000 is a project that promotes social change through individual involvement and relies on the strength of local organizations to respond to local needs while meeting global environmental and social goals. The project is action-oriented. There is no explicit philosophy that challenges the existing world view. However, the activities it promotes (such as the inventory and Cross-Canada trail project) reflect some of the principles of ecological and social sustainability at the community level. Additional ideas outlined in the manual are practical and implementable. However, like many non-governmental organization activities, the project is to this point underfunded and relies primarily on the energies of dedicated volunteers to promote its ideas.

Waging Peace Proposal

Contact:

Walt Taylor
Waging Peace Secretary

"Waging Peace for a living: Mobilization for Sustainable Global Development" is a project proposal waiting to be implemented. It attempts to dispell two myths that pervade our modern economies: "(1) Work is scarce; not enough work for everyone; and (2) Money is scarce; Canada cannot afford full employment" (Taylor 1989). The project recalls the ability of Canada and the United States to pull out of the Great Depression and provide full employment and a booming economy within two years of the start of World War II. Once the threat was recognized, the country was mobilized and the resources were made available. Waging Peace contends that the current state of the planet poses a far greater threat to our security and well-being than any war. The project is a call to mobilize people and resources to carry out the vital work to sustain life on Earth.

Waging Peace is described as a demonstration project that could be carried out in any community. It consists of three key phases or plans. Plan A and Plan B are initial research activities that must be started before action can take place. Plan A is the preparation of a community inventory of all the work that needs to be done to protect and rehabilitate the environment and to prepare for a higher quality of life for everyone. The inventory would outline the job descriptions, training and counselling needs, tools, facilities and budgets to complete the required work. Information would be gathered from

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organizations concerned about the environment, human rights, peace, education, sustainable community development, poverty, non-violent conflict resolution and changing our way of thinking. Plan B would identify ways in which resources could be found to support workers in these efforts. Plan C is the implementation stage when the community (or an individual) draws on the inventory to select work opportunities that fit the needs and conditions of the community and to find appropriate sources of funding the work.

The fundamental assumption of full employment in the Waging Peace proposal is a challenge to the status quo of our modern industrial economies. Unfortunately, without a demonstration of the project it is difficult to determine whether the initiative would reflect the principles of a new ecological world view. Certainly the intention appears to be that the work needed to save the planet would ultimately lead to sustainable community development.

The strength of the project is its identification of the need to mobilize both information and resources to guide community efforts. An inventory of essential work would provide the community with a means of prioritizing its efforts in the most effective way. An inventory of resources would ensure that the completion of this work is not dependent on volunteer labour or the goodwill of those with vested interests in the status quo. In addition, the project encourages the participation of a wide cross-section of the community in the identification of needed work.

Community Land Trusts

Land trusts have been used to protect ecologically important areas (e.g. wildlife habitat, community forests, wetlands, greenspace in urban areas and community gardens) from development since they were first introduced in the United States in the 1950s (Land Trusts' Exchange 1988). Establishing a land trust is simple in legal terms but it also requires that the land to be protected is purchased or donated and placed in the trust. Land trusts effectively eliminate the threat of development by permanently removing the land from the market. The articles of the trust are drawn up by the trustees and define the allowed uses of the land.

A community land trust (CLT) operates in a similar manner to a traditional land trust to protect land. However, a CLT also attempts to address the social and economic dimensions of land by encouraging land uses that provide essential community needs for housing, food and a clean environment. The CLT is a non-profit organization operated by a board of trustees generally consisting of community members and lessees of trust land. The trust ensures that the land is cared for in perpetuity. Generally the trust retains title to the land and issues a life time inheritable lease to the occupants of the land.

Land trusts do not provide a grand scheme for changing our world view or promoting a massive shift in individual values. However, the fact that a trust permanently removes land from the market is a challenge to the fundamental assumption in our market economy that land is merely a commodity to be bought and sold at a profit and developed for the benefit of humanity. As a community-based initiative, it encourages individuals and the community to become involved in the long-term protection of valuable ecosystems and the wildlife that depends on those systems. A traditional land trust reflects the ecological principles involved in land stewardship. The community land trust

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attempts to reflect the need to balance the ecological and social principles of sustainability. The success of land trusts as a means to create sustainable communities depends on how well these individual efforts are co-ordinated within and between communities and whether the lessons learned from these experiments are transferred to society at large.

Community Economic Development Initiatives

Community economic development initiatives have emerged in response to the failure of existing central planning and economic development institutions to provide long-term solutions to the economic problems of high unemployment, industrial decay, poverty and rural decline (Lotz 1987, Dauncey 1988). Organizations for community development range from informal non-monetary efforts such as the local exchange trading system established in Courtney B.C. (Davis and Davis 1987), to non-profit organizations, co-operatives and the more formal community development corporation (MacLeod 1986, Wismer 1981). These initiatives provide opportunities for communities to become more self-reliant and less subject to the vagaries of the global free market. They encourage communities to organize local resources to create employment and capital in a manner that also meets the social and environmental concerns of the community.

As one of many community development organizations, the community development corporation (CDC) illustrates some of the strengths and weaknesses of community development initiatives as a means of creating sustainable communities. A CDC is organized by community members for the benefit of the community by combining social purpose (as defined by the corporate goals) with economic realities (working to fill the gaps created by the mainstream economy). To be successful as a means of restoring a degree of community autonomy, the CDC must also ensure its own survival. Therefore CDCs normally adhere to two criteria: 1) it must be viable in a commercial sense, and 2) it must contribute to the community in some way beyond creating jobs (MacLeod 1986).

Community economic development initiatives do not explicitly challenge the existing world view or encourage others to change their values. However, their existence suggests that poverty, unemployment and loss of community are not acceptable. The

community-based approach to development promotes a renewed sense of community social responsibility and self-reliance. However, the extent to which CDCs can contribute to building sustainable communities depends on the values and concerns of those involved in organizing and managing the corporation. If the CDC is restricted to activities that are socially and environmentally sustainable, it could be a valuable tool.

International Program -Federation of Canadian Municipalities

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The Federation of Canadian Municipalities (FCM) established its International Program in response to the growing need for knowledge and expertise in managing the problems of explosive urbanization in developing countries. With the co-operation and funding of the Canadian International Development Agency (CIDA), FCM is involved in co-ordinating several programs (Twinning, Municipal Professional Exchange Project, Chinese Open Cities, Africa 2000-The Municipal Response) to create mutually beneficial links between communities in Canada and the developing world which helps to achieve a degree of international equity: an essential element to creating sustainable communities.

Twinning:

Twinning is a program to establish a long-term relationship between a Canadian community and a community in another part of the world. More than 100 Canadian communities are already twinned (some with more than one sister city). The motivations for entering into a twinning arrangement range from promoting understanding between different cultures to developing foreign trade and business opportunities, providing humanitarian aid and sharing expertise. Communities generally sign an agreement or protocol outlining the objectives and in some cases the terms of the relationship. Successful twinning requires community support and involvement through activities such

as cultural or educational exchanges, sports competitions, or club affiliations (e.g. Rotary or Lions' clubs).

Municipal Professional Exchange Project:

Shortages in clean water, housing, employment, urban sprawl(slums), and adequate medical care are some of the urban problems common to communities in the developed and developing world. The Municipal Professional Exchange project involves short term exchanges between municipal administrators in Canada and a developing country on specific projects. Participating municipalities are required to contribute staff time while other costs are covered by CIDA. The exchanges are meant to be a two-way exhange of ideas. Canadians develop new perspectives and solutions to familiar problems while administrators from the developing world learn about the successes and failures of modern approaches.

Chinese Open Cities:

The Chinese Open Cities project was developed in response to a Chinese request for assistance in developing their business management and municipal government administration skills in anticipation of the rapid development of their economy as it is opened to the outside world. China designated fourteen Coastal Cities, four Special Economic Zones and three Delta areas to be open to foreign trade, joint business ventures, and foreign investments to help in the modernization of the country. The emphasis of this program is on providing training to Chinese officials in municipal management, economic development, environmental protection, infrastructure construction, and international marketing to promote growth. Despite the emphasis on economic growth, the project has potential to make Chinese communities aware of the environmental downside to economic growth by learning from our mistakes. The first issue of Gateways, the newsletter of the

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Chinese Open Cities project, focused on sustainable development and environmental problems in Chinese and Canadian cities.

Africa 2000 - The Municipal Response:

The Africa 2000 project is the most promising of the FCM initiatives in terms of promoting sustainable community development. It is a municipal response to comprehensive development assistance for African communities. After a one year pilot phase involving 11 linkages (22 communities), FCM has recommended that the project continue for an additional four years. The project builds on the concept of twinning. Canadian communities are linked with an African community to develop a long-term relationship and to co-operate in the following areas: exchange of municipal officials, purchase of capital equipment to meet the immediate needs of African municipal administrations, municipal environmental assessment, support for community-based projects and other innovative initiatives. Africa 2000 provides an opportunity for the entire community to become involved in development assistance.

All of the above programs provide excellent opportunities for Canadian communities to increase their understanding and concern for the problems facing developing countries - an important aspect of sustainable development. They are also opportunities for Canadians to become directly involved in activities (sharing knowledge, expertise and resources) that help to meet the basic needs of the human population and to narrow the economic gap between developed and developing countries. The emphasis on sharing expertise in environmental assessment and community-based projects in the Africa 2000 program is particularly useful in promoting sustainable community development.

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APPENDIX II - GLOBAL ACTION PLAN FOR THE EARTH

Environmental Global Action Goals
For The 1990s
(From Global Action Plan for the Earth - Project Outline)

We all know the bad news: pollution and environmental destruction have been getting worse every year, and many scientists now say that if we don't turn things around during the 1990s we'll enter the 21st century in a severely – perhaps irreparably – damaged world.

What most people don't know is that there is also powerful good news. For every environmental problem we face there already exist well-tested solutions that are both technologically and economically practical. World commissions and environmental specialists have developed a strong consensus about the nature of the problems and their most promising solutions.

Their key recommendations have been pulled together and turned into the following set of environmental goals for the world. All of these goals represent minimum requirements, and they are all quite do-able. As the decade progresses we are likely to find that we can exceed these goals, but for now the important thing is to start moving in the right direction.

The **Global Action Plan For The Earth (GAP)**, an international non-governmental organization, and the organizers of Earth Day 1990 are collaborating in launching these as goals to be achieved over the next 10 years. GAP's purpose is to translate these goals into measurable, personal, workplace and community actions keyed to the global goals; provide skills and support systems to assist in achieving these local actions; and then collect the results of these actions and feed them back out through the media and other channels of communication. GAP will empower us by showing how our individual and local actions are having a global impact, and that it is *precisely* through local action taking place all over the world that we can achieve the global environmental goals necessary to sustain the quality of life on our planet.

To be Achieved by the year 2000

Preserve the Climate and Atmosphere:
- Decrease carbon dioxide emissions by 20% through increased energy efficiency and increased use of renewable energy sources to slow global warming.[1]
- Eliminate production of CFCs and other ozone depleting chemicals.[2]
- Decrease emissions of sulfur dioxide by 90% and nitrogen oxides by 75% to abate acid rain.[3]

Preserve the Diversity of Life:
- Triple the area of protected ecological preserves.[4]
- Reduce deforestation by 50%.[5]
- Increase reforestation enough to offset deforestation by planting 320 million acres of trees in developing countries and 100 million acres in industrial countries.[6]

Reduce Waste:
- Reduce solid waste by 70% through recycling, source reduction and composting.[7]
- Cut the production of hazardous waste by a third or more.[8]

Use Water Wisely:
- Reduce water use by a third or more through more efficient use in agriculture, industry, and households.[9]
- Provide safe drinking water for all.[10]

Stabilize Humanity:
- Reduce the rate of world population growth by 50%.[11]
- End hunger.[12]

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Interaction Matrix between the Global Goals and the Community Action Areas

	Preserve the Atmosphere	Decrease CO2 emissions	Eliminate CFCs	Decrease SO2 and NOx	Preserve the Diversity of Life	Triple eco-preserves	Reduce deforestation	Increase reforestation	Reduce Waste	Reduce solid waste volume	Cut production of hazardous wastes	Use Water Wisely	Reduce water use	Keep water clean	Stabilize Humankind	Reduce population growth	End hunger
Improve Energy Efficiency																	
HVAC in public buildings		X	X	X													
Lighting		X		X													
Other		X		X													
Improve Water Efficiency																	
Fix leaks in mains													X	X			
Other													X	X			
Improve Transportation Efficiency																	
Public transport		X		X													
Biking & walking routes		X		X													
Zoning to reduce commuting		X		X													
Reduce Waste																	
Recycling		X	X	X			X			X							
Hazardous materials			X								X			X			
Let Your Voice Be Heard																	
Suppliers		X	X	X		X	X	X		X	X		X	X			
Citizens		X	X	X		X	X	X		X	X		X	X		X	X
Community		X	X	X		X	X	X		X	X		X	X		X	X
Government		X	X	X		X	X	X		X	X		X	X		X	X

GLOSSARY

Autotroph: An organism that assimilates energy from either sunlight (green plants) or inorganic compounds (sulfur bacteria). *

Biodegradable: capable of being broken down by bacteria into basic elements and compounds. +

Biogeochemical cycles: mechanisms by which chemicals such as carbon, oxygen, phosphorus, nitrogen and water are moved through the ecosphere to be renewed over and over again. The three major types are gaseous, sedimentary and hydrological. +

Bioregion: term combining life (bio) and territory (region). Boundaries of a bioregion are determined by self identification (i.e. discovered by each person through physical encounter). Boundaries are characterized by a biotic shift (a significant change in plant and animal communities from one region to another); a watershed; our awareness of a spirit or sense of place; and its cultural distinctiveness. #

From the preamble to the first North American Bioregional Congress in 1984:

"A growing number of people are recognizing that in order to secure the clean air, water and food that we need to healthfully survive, we have to become stewards of the places where we live. People are discovering that the best way to take care of ourselves, and to get to know our neighbors, is to protect and restore where we live.

Bioregionalism recognizes, nurtures, sustains and celebrates our local connections with: land, plants and animals; river, lakes and oceans; air; families, friends and neighbors; community; native traditions and systems of production and trade.

It is taking the time to learn the possibilities of place.

It is mindfulness of local environment, history and community aspirations that can lead to a future of safe and sustainable life.

It is reliance on well-understood and widely used sources of food, power and waste disposal.

It is secure employment based on supplying a rich diversity of services within the community and prudent surpluses to other other regions.

Bioregionalism is working to satisfy basic needs through local control of schools, health centers, and governments.

The bioregional movement seeks to recreate a widely shared sense of regional identity founded upon a renewed critical awareness of and respect for the integrity of our natural ecological communities.

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People can join with neighbors to discuss ways we can work together to 1)Learn what our special local resources are, 2)Plan how to best protect and use those natural and cultural resources, 3) Exchange our time and energy to best meet our daily and long-term needs, and 4) Enrich our children's local and global knowledge.

Bioregionalism begins by acting responsibly at home. Welcome home." (quoted from Devall)

Carrying capacity: maximum population that a given ecosystem can support indefinitely under a given set of environmental conditions. +

Climax ecosystem: a relatively stable stage of ecological succession; a mature ecosystem with a diverse array of species and ecological niches, capable of using energy and cycling critical chemicals more efficiently than simpler, immature ecosystems. +

Community: group of plant and animal populations living and interacting in a given locality. +

Consumer: organism that lives off other organisms. Generally divided into primary consumers (herbivores), secondary consumers (carnivores) and microconsumers (decomposers). +

Diversity: physical or biological complexity of a system. In many cases it leads to ecosystem stability. +

Dynamic equilibrium state: state in a closed system that is maintained in balance by the dynamic flow of energy through the system and the cycling of critical chemicals within the system. +

Dynamic steady state: dynamic state of an open system where the input and output of matter and energy of the system are balanced by a steady flow. Any living organism can be described as an open system in a dynamic steady state. +

Ecological efficiency (food-chain efficiency): the percent transfer of useful energy from one trophic level to another in a food-chain. +

Ecological succession: change in the structure and function of an ecosystem; replacement of one kind of community of organisms with a different community over a period of time. +

Ecosystem: All the interacting parts of the physical and biological worlds. *

Entropy: measure of disorder or energy not available for useful work. +

Feedback: signal sent back into a self-regulating, or homeostatic system, which is then processed by the system. +

First law of thermodynamics (energy): in any ordinary chemical or physical change, energy is neither created nor destroyed, but merely changed from one form to another. You can't get something for nothing, you can only break even. +

Food-chain: sequence of transfers of energy in the form of food from organisms in one trophic level to those in another when one organism eats or decomposes another. +

Holistic: view that nature can be understood only by looking at it as a general complex system of parts and wholes. +

Heterotroph: an organism that utilizes organic materials as a source of energy and nutrients. +

Homeostasis: Maintenance of constant internal conditions in the face of a varying external environment. *

Homeostatic (cybernetic) system: self-regulating living system in which control of key variables or responses is maintained by information feedback, allowing the system to accommodate new conditions. +

Negative feedback: flow of information into a system that causes the system to counteract the effects of an input or change in external conditions. +

Nutrient: element or compound that is an essential raw material for organism growth and development. Examples are carbon, oxygen, nitrogen, phosphorus and the dissolved solids and gases in water. +

Open system: system in which energy and matter are exchanged between the system and its environment. A living organism is an example. +

Photosynthesis: Utilization of the energy of light to combine carbon dioxide and water into simple sugars. *

Positive feedback: feedback where the information sent back into a homeostatic system causes the system to change continously in the same direction; as a result, the system can go out of control. +

Producer: organism that synthesizes its own organic substances from inorganic substances, such as green plant. +

Second law of thermodynamics (law of energy degradation): (1)In all conversions of heat energy to work, some of the energy is always degraded to a more dispersed and less useful form, usually heat energy given off at a low temperature to the surroundings or environment, or you can't break even in terms of energy quality. (2) Any system and its surroundings (environment) as a whole spontaneously tend toward increasing randomness, disorder or entropy. +

Stability: Inherent capacity of any system to resist change. *

Synergy: interaction in which the total effect is greater than or less than the sum of two effects taken independently. +

Ten percent law: only about 10 percent of the chemical energy available at one trophic level gets transferred in usable form to the bodies of the organisms at the next trophic level in a food-chain or food web. +

Threshold effect: phenomenon in which no effect is observed until a certain level or concentration is attained. +

Trophic level: level shere energy in the form of food is transferred from one organism to another in a food-chain or food web. +   155

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