Sustainability Manifesto

Exploring Sustainability:

Getting Inside the Concept

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Contents:

Executive Summary

Stable, global economic activity is directly dependent upon the state of human and natural resources in our world today. And over the last few decades people and institutions have come to better understand that society's collective demand on resources is becoming greater than the productive capacity of the Earth, potentially resulting in serious social, economic, and environmental consequences unless we can find means to use fewer resources in more efficient ways. In addition, social and economic disparities among the expanding global population are wide and growing, resulting in more international conflict among the haves and have-nots. Our consumption of resources and waste production is clearly unsustainable, with dire consequences for our way of life if not addressed. And the consequences for future generations are sobering. Do those living today owe anything to the future? What economic, social, and political choices can we still make so that we don't meet the same ends as many past civilizations? The interdependencies in our world require new ways of thinking about things and taking action that will truly create a healthy future where society and nature coexist with mutual benefit, and where the suffering caused by poverty and natural resource abuse is eliminated. One potential solution to global socio-economic and/or environmental decline can be found in the application of sustainable development. Sustainable human development is not about having more but about being more. This shift in attitude is guaranteed to promote personal fulfillment and sharing, and can also reduce unnecessary consumption. But without clearer understanding and agreement with regards to what sustainable development is about, it offers no substance for those really wanting to implement actions that are believed to be sustainable.

The concept of sustainable development is much more than environmental protection in disguise. It offers a multi-dimensional way of thinking about the interdependencies in our world while helping humanity to meet the needs of the present without compromising the ability of future generations to meet their needs. Seeking sustainable solutions requires the consideration of relationships between economic, social and human health, and environmental concerns – working to improve people's well-being without damaging or undermining society or the environment. Integrating these calls for development that improves the quality of human life and at the same time conserves the vitality and diversity of the Earth; maintaining one at the expense of the other is not acceptable. Confusion about sustainable development and the inability to act sustainably arises from what can be called the triple threat to sustainability because traditionally economic, social, and ecological issues are solved as separate, isolated problems. A new model of problem-solving must consider each issue systematically and strategically, addressing primary concerns and how these relate to one another across the different sectors. Ecological sustainability is the simple part of the concept. Socio-economic sustainability, however, is a more difficult and potentially contentious concern. The question of who gets what (and how) from increasingly limited economic production raises the specter of potential conflict both within and between nations. How do we distinguish between essential needs today and wants – those that are supplementary or excessive? And likewise, how do we distinguish between the needs of potentially very different cultures or people in the future compared to present-day society? Success in the short-term with

regards to economic goals often overshadows triple threat issues that can set in motion both social and ecological processes, undermining the foundation of a stable functioning environment – changing what presently might be viable opportunities into constraints sometime in the future.

Today numerous claims of stressed natural resources and unstable human societies are viewed by many as doomsday paranoia. Uncertainties about the world around us, as well as the contradictions many of them pose, suggest why debates about sustainable development often are reduced so quickly into disputes about whether or not continued material growth and consumption are feasible. The greatest power of this concept and the brilliance of the sustainability movement lie in its emphasis on integration – its demand for seeing things as interrelated and interdependent. But how do we encourage the average citizen to embrace these sometime complicated ideas of interconnected factors? It becomes important for us to take advantage of the power of being able to visualize via diagrammatic illustrations the theoretical underpinnings of sustainability. Imagining how our world is interconnected, for example through the 3-overlapping circles or 3-legged stool diagrams, is the first step in assisting humanity to identify a sustainability philosophy they can relate to. Its ethic can be promoted more confidently from visualizing and understanding the interconnections that sustainability implies – the ability to provide a bridge between disciplines and interests, between the pieces of the whole and the whole itself. Likewise it is important that we go back to the fundamental, non-refutable basis of why concern for sustainability has become a global phenomenon. Conversation on sustainability has to be in touch with the basic scientific truths that form the foundation for a sustainable future – those facts that pull us back to the roots of the problem. By promoting their discussion we can influence constituencies with vastly different viewpoints to focus upon facts they can commonly agree to because they are irrefutable, according to scientific understanding for the way nature and society function. Using these areas of strong consensus as a starting point, it becomes easier to have a dialogue about environmental and socio-economic sustainability, especially when the concerns of society are often messy and cross the traditional boundaries of economic, social, and environmental interests. Nature and people are endlessly and inescapably under the influence of one another through connecting relationships. Working within the framework of these interconnections and the guidance of some fundamental truths is the essence of sustainability.

Sustainable development is the taking of actions through a system's approach, to define our problems and solve them in a way that is long-lasting. We can begin by developing a simply stated concept of sustainability that most can agree with. Then establish a community-based set of principles that integrate information characterizing human understandings, relationships, and activities, that will actually move across the traditional sector boundaries to successfully address sustainability issues. This simple framework can be turned into specifics by real communities of people that choose important criteria and indicators based upon their particular values. Processes must remain flexible, however, because what works in one community may not work in another or may work for different reasons. One size does not fit all! So what would a simple, graphic definition of sustainability look like for a community embarking upon this journey? Living sustainably is maintaining the important mix of options and opportunities while creating no new and onerous constraints; living unsustainably is losing them, narrowing the range of options that people in other places or subsequent generations can choose among in their attempt to adapt, survive, and prosper. Sustainability is most fundamentally equity over time and place, making sure we consume less than Earth's natural resources can provide. Economic development that is sustainable must be both environmentally sound and shared fairly among all societal members. Not to meet this objective is to open the doors of conflict.

The sustainability movement can gain strength from a core belief in the human capacity for goodness by drawing connections between for example, our current consumer behaviors and our religious and/or spiritual beliefs. Decisions and actions guided by a shared morality within society that includes limited consumption, nonviolence, and ego-less collaboration, can ultimately have the effect of reversing unsustainable trends. There can be no sustainability without a social order guided by shared aims. And this shared aim or solidarity comes from human moral philosophy promoted by one's own spirituality or

relationship to one of many different religions and their basic beliefs. And a set of principles can be established and agreed to in order to guide this spiritual-based approach that then makes it systemic. By considering the integrated application of principles discussed here, decision-making can encourage protection and equitable distribution of resources to create a sense of fairness, identifying and satisfying real needs before wants and leaving options open for future generations. In this way sustainability challenges society to set specific goals and then continuously align its strategy and operations toward that end. To assist in identifying specific goals and defining action strategies, including describing transitional steps toward sustainability, sustainability practitioners are beginning to rely upon the participatory, transparent, and all-inclusive advantages offered by application of citizen science. To help anticipate and avert the impacts of unintended outcomes we can develop models for doing science in a more interactive and inclusive way, providing awareness and integrated discourse, making active partners of all parties, and ensuring full participation of all potential stakeholders. An effective model in this regard is the application of citizen science that supports an adaptive management strategy. Adaptive management is the search for community practices that maintain the options important to a culture living in a place –a strategy that can both reduce uncertainty regarding particular matters affecting management decisions and reduce disagreement about goals, objectives, and values. Adaptive management starts where we are and struggles toward better policies through social learning, providing a very simple model for conceiving the difference between sustainable and unsustainable communities.

The essence of sustainability therefore, is to take the contextual features of economy, society, and environment – the uncertainty, the multiple competing values, and the distrust among various interest groups – as givens and go on to design a process that guides concerned groups to seek out and ask the right questions as a preventative approach to environmentally and socially regrettable undertakings. But, the central principles of sustainability are not always well elaborated or applied. Additionally, many communities, and other kinds of organizations, lack the know-how to assess the costs and benefits of economic development opportunities, especially as they relate to environmental and societal issues. There is a gap in awareness about what sustainable development represents and existing instruments are not being used to their full potential. The time has come for professionals to lead multi-dimensional ways of thinking about a future for our children in which environmental, societal, and economic concerns are considered equally and at the same time, in pursuit of an improved quality of life for everyone. We will achieve sustainability when we understand the economic, social, and environmental consequences of our actions and make deliberate choices that allow all people to lead healthy, productive, and enjoyable lives, now and in the future, without unintended consequences. The challenge for practitioners is to recognize the needed context of interdisciplinary scientific understanding and promote the taking of actions that reach across boundaries, disciplines, and cultures. A number of "tools" are briefly described here that can be used to assist practitioners and benefactors in their progress toward sustainability, supporting the application of citizen science and adaptive management.

Sustainable development is seen as a means of enhancing decision-making so that it provides a more comprehensive assessment of the many multi-dimensional problems society faces. What is required is an evaluation framework for categorizing programs, projects, policies, and/or decisions as having sustainability potential. The objective of the approach to an assessment protocol described here is to assist practitioners and decision-makers in developing more informed choices for taking action by evaluating the large-scale impacts that might result from a defined project or program, while also demonstrating the desire to promote accountability for sustainable action-taking. The described testing for sustainability must be done in the context of what has been described here regarding processes of citizen science and adaptive management, to complement the evaluative picture. Application of an iterative sustainability assessment protocol, based upon a sound foundation of basic understanding for what sustainability represents, can help to build a transparent, defensible basis for decisions.

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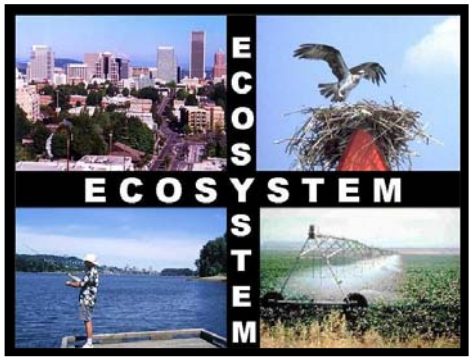
Forward

I cannot count the number of times in my sustainable development work when I have gone rummaging through file cabinets looking for specific information regarding a particular fact about sustainability. Out of frustration, I finally decided to try and put all in one place the many different details I have accumulated through the last decade on this topic. That is the reason for this manifesto. It represents what I have discovered through my own work as well as what I have learned from the cutting edge work of others on sustainable development – exploring its meaning and getting inside its implementation. This writing is an effort to synthesize and integrate significant amounts of detail and many ideas that exist on different elements of the global sustainability picture. With this information all in one place one can more effectively advance society's collective wisdom for this concept and advocate for its important influence on the future design and implementation of development projects and programs that simultaneously impact society and the environment. The sequence of manuscript sections is significant because they represent a hierarchical development of background toward the expression of our understanding for this complex subject area into an almost crescendo-like, very simple interpretation of sustainability. Following this interpretation, with all the background information to support its rationale that the general public can embrace, I have provided several sections that focus upon sustainable development implementation, including tools to use and means of testing for sustainable outcomes. Although some of the ideas are my own, I have also borrowed extensively from many different persons engaged in sustainable development teaching, research, and practice in order to identify the extent of our knowledge in calling attention to the significance of sustainability goals in the growing global society. I want to thank those whose perspectives have been helpful. I hope I have adequately identified their ideas in this writing.

Is Our Global Society On-Track to a Healthy Future?



The Earth and all its resources are a closed system governed by irreversible energetic processes often referred to as the Laws of Thermodynamics. As such it behaves as a single, self-regulating structure comprised of physical, chemical, and biological components, including humans (Robert, et al., 1997). And all of these components interact in diverse, complex ways through the function of ecosystems that integrate (**a**) the level of energy and raw materials used, (**b**) the solid, liquid, and gaseous wastes produced, and (**c**) the collective socio-economic impacts imposed on these pathways of system life support (Flint, 2004a).

Because of this closed system, over the last few decades people and institutions have come to better understand that Earth has limits to its ability to provide for the exponential growth in impact of its human population (Bartlett, 1999). According to the World Resources Institute (Matthews, et al., 2000), over the next 50 years, projections suggest that:

- The world's population may increase by 50 percent.
- Global economic activity may increase by 500 percent.
- Global energy consumption and manufacturing activity may rise to three times current levels.

These trends could have serious social, economic, and environmental consequences unless we find means to use fewer resources in more efficient ways (McDonough and Braungart, 1998). And in using fewer resources we must also guarantee that these savings are not just passed on for someone else's advantage, resulting in no savings (net gain) at all (Gibson, 2002).

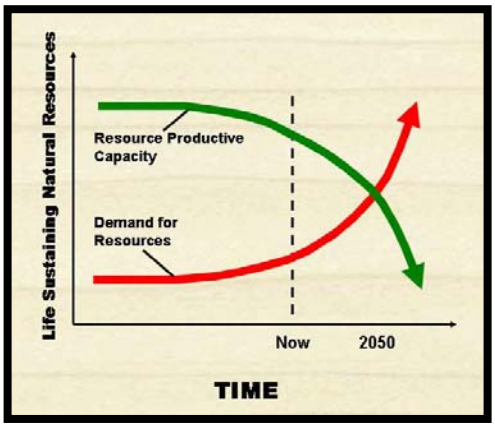
A big part of our present environmental problem is society's loss of connection to nature (Flint and Houser, 2001). Amongst all the concrete, steel, pavement, and rooftops it is easy to see why this disconnect has occurred. We come out of our houses to shop, go to work, go to dinner, or perhaps even go to the gym for the more motivated. We are willing to walk 10 miles on a machine yet fight for that close parking spot. Our patterns are fairly predictable. Our consumerism almost occurs at a cellular level – tendencies that gravitate towards what we are told are an endless supply of everything. And this religion of consumerism has its attendant form of spirituality – the will to mastery over nature (McDaniel, 2002). Why should we sacrifice the good life, decrease our consumption, or worry, since things seem to be OK or can be controlled by technology?

But things are <u>not</u> OK! At the present time for example, food, freshwater, and energy shortages are sparking social tension and global conflict (Brown, 1999a; Lazaroff, 2000). Pollution problems persist. Garbage is accumulating. Deforestation, soil loss, and habitat destruction are extensive. Rates of species extinction are up, wetlands continue to disappear, and global fish stocks are declining (Flint and Houser, 2001). Environment-related health problems account for many of the illnesses in the world today. Roughly half the world's population lives in poverty (Hartman, 1997). The global climate appears to be changing because of anthropogenic emissions of greenhouse gases (Vorosmarty, et al., 2000). And many believe climate change is a cause for the increased intensity of devastating Atlantic tropical storm systems in recent years.

No one of these problems can be called the single most important, because any of these if not addressed can do us grave harm, and **because they all interact with each other** (Diamond, 2005). Therefore, even if we solved all but one of these problems we would still be in trouble from whichever was the problem that went unsolved.

The foundation for most of these problems is human economic demand. The totality of the human economy is measured by throughput. It is calculated as the total number of people multiplied by their consumption of resources and waste production. Thus, there is consistently a dependence of economic activity on human and natural resources. There is considerable evidence now that the use of natural capital by many parts of our economy, in the process of throughput, has exceeded the regenerative and absorptive capacity of the environment (Daly, 1996). The bottom line – society's collective demand on

resources is nearing the productive capacity level of the Earth (natural resource capital versus human demand projections illustrated in the adjacent diagram). The problem of climate change and global warming are commonly reported examples. These issues provide evidence that we have exceeded the capacity of the atmosphere to absorb our carbon dioxide, methane, and nitrogen oxide wastes. The declining state of many ocean fisheries is another genuine example of our world's limitations.



In sum, there are no limits to growth in wisdom and other forms of human development, but there are physical limits to growth in the consumption of resources, and there are physical limits to how much waste can be dumped into the biosphere. And these impacts continue to grow because of our increasing numbers, technologies, and affluence (Gibson, 2002; Flint, 2004b). Social and economic disparities among the expanding global population are also wide and growing, resulting in more international conflict among the haves and have-nots. Much about our current situation is clearly unsustainable, with dire consequences for our way of life if not addressed (Brown, 1999b). And the consequences for future generations are sobering.

What we are talking about here is the dynamic condition of complex systems, particularly the biosphere of Earth and the human socio-economic systems within it (Heintz, 2004). As we know from biology and ecology, the underlying organization of life in Earth's biosphere has endured for over 3 billion years because it is very good at always striving for stability among systems – the many dynamic components interact with each other in ways that allow each component to adjust while the whole endures. Therefore, the reality of impacts on these complex systems from human activity is that circumstances will change toward some kind of equilibrium condition over time. The only question is whether changes will occur in pleasant ways of our own choice – through solidarity and the taking of stewardship for Earth systems – or in unpleasant ways not of our choosing – inhumane and natural earthly phenomena take over and do it for us at severe human detriment, such as warfare, genocide, starvation, epidemics, or failure of societies (Sagoff, 1997; Orr, 2002).

Historically many civilizations have collapsed from human activities such as over-farming and over-population (Diamond, 2005), while the planet has endured. There is much to be learned from understanding the history of past civilizations, the cultural attributes that have developed in different societies through time, the way their ancestors went about living, playing, working, and growing, and the fact that time of societal decline in different cultures through history has been decreasing as we move toward the present-day (Gore, 1992). We live in a time of significant global environmental change, the consequences of which remain poorly understood. Given current trends and uncertainty in future events, human's secure presence on Earth is not necessarily guaranteed over the next millennium (Marshall and Toffel, 2005).

What is Required to Change Present Conditions?

Communities face enormous challenges as their social, economic, and environmental resources are damaged or depleted by acts of humanity. Because these elements are interconnected, there are no simple solutions to the challenges. In olden times survivors of dying communities could move on to less populated, more fertile areas. But today there is no such place left to go! Do those living today owe anything to the future? If "yes," then we must now determine what and how much we owe future generations, least our present course continues unabated too far into the twenty-first century, eventually to destroy options for all generations to come.

In the ultimate analysis, a timely reversal of these resource depletion and natural Earth cycle disruption trends is contingent on human decisions. What economic, social, and political choices can we still make so that we don't meet the same ends as many past civilizations? And more importantly, how do we integrate these choices across sectors to be most effective in solving present problems? Consider the plight of many African countries now that are in continual states of poverty, upheaval, and warfare. Are we really addressing their problems in an integrated manner when we concentrate on the apparent symptoms instead of attacking the many common causes of these very diverse issues? Decisions and actions guided by the patriarchal mindset of excessive consumption and wealth accumulation, excessive concentration of power, and excessive ego gratification, will only exacerbate the present destructive trends of our global society. Decisions and actions guided by the solidarity ethos of moderate consumption, diplomacy, and ego-less collaboration, can reverse these trends.

Many are now coming to believe that one potential solution to global socio-economic and/or environmental decline can be found in the notion and application of sustainable development. Sustainability is a concept that describes a dynamic condition of the Earth's biosphere and its various systems, focusing in particular on human social and economic systems and their interactions with the non-human elements of the biosphere, the environment (Heintz, 2004). The characterization of a sustainable future represents the expression of people's basic values and concerns, communicating their ideas of a good life and their hopes that it will endure for future generations.

Whatever issues we find ourselves facing, be it disease, child abuse, crime, injustice, weakened economies, energy shortages, lack of good jobs, extinction of species, poverty, destruction of forests, pollution, breakdown of families, armed conflict, or nuclear power expansion, there are common threads and interconnected solutions to these seemingly diverse problems. These interdependencies require new ways of thinking about things and taking action (Gibson, 2006b) that will truly create a sustainable future where society and nature coexist with mutual benefit, and where the suffering caused by poverty and natural resource abuse is eliminated.

For example, most regions wanting an improved quality of life are economically driven. Therefore, economics becomes the necessary vehicle for change. The roadway upon which we are driving is our economy's ecological base of nature with its resources; and society is the driver (Maser, 1997). The only hope for sustainability then is a shift in societal ethics and culture which considers global population dynamics and more responsible consumerism, both of which if left unchecked are the factors most demanding of economic growth.

Because individual and collective economic vitality is an important element of any community, in order to advance economic security extant, sound economic opportunities must be preserved and new development encouraged. Generally, fiscal vitality is founded in "a healthy ..... economy that diversifies and co-develops sufficiently to create meaningful jobs, reduce poverty, and provide the opportunity for a high quality of life for all in an increasingly competitive world" (President's Council on Sustainable Development (PCSD), 1996:15). Furthermore, ecological integrity cannot be achieved unless jobs are environmentally "clean" in that they do not contribute to air or water pollution or create toxic wastes. Paying attention to what characterizes healthy natural ecosystems ensures "that every person enjoys the benefits of clean air, clean water, and a healthy environment at home, at work, and at play" (PCSD, 1996:14). This goal is met, in part, through conserving natural resources and decreasing exposure to toxic substances and environmental hazards.

At the same time, scientists are acknowledging the increasing danger to people, plants, and animals from continued degradation of ecological life support processes (ecosystem services) and natural cycles (*e.g.* carbon cycle) by human economic activities harmful to natural systems and resources (McMichael, et al., 2003). Social scientists and policy makers are promoting the need for societal and economic improvements so that all communities can implement better programs to alleviate poverty and protect material resources through more sound development, while taking charge of their own destinies (Gibson, 2002) – thus, the call for "sustainable development." Sustainable development is a program of action that has emerged from people's basic values, from concerns about the consequences of past development, and from scientific understanding for the long-term detriments from degraded environmental and social capital (Heintz, 2004).

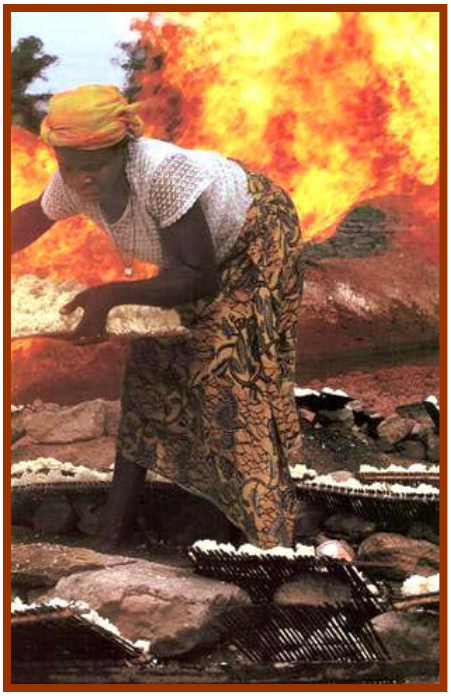
But, the phrase "sustainable development" can be ambiguous. Many identify with the sustainable part and hear a call for ecological and social transformation, a world of continuous healthy environments and social justice. Others identify with development and interpret it to mean more sensitive economic growth, a significantly reformed version of the status quo. But the minute one equates development with growth, problems immediately arise. General failure to distinguish between true development and mere growth is the basis of much confusion in our efforts to operationalize problem-solving that is fair (Daly, 1996).

To change the world we must meet head-on the differences between growth and development. Clarifying this confusion is essential to understand sustainable development's true potential. Development cannot be equated to growth because growth implies a quantitative increase in physical

size of something (*e.g.*, population or economic expansion), which will always face limits (Daly, 1992). Continued growth in the political context implies increasing endlessly which can mean the growing quantity will tend to become infinite in size. As an example, politicians often call for continued economic growth in order to remain healthy, as judged by more jobs and more money flow, and meet expanding consumer needs. We all understand how this is not possible in the context of earthly limitations. Earth is finite, one size, not growing. Thus, there is no such thing as sustainable growth because growth will inevitably hit physical limits. Consider the fate of oil in our world today. You can only "grow the pie" so much and when you do the gap between the haves and have nots only enlarges.

Development on the other hand, is the realization of a greater potential – qualitative improvement, recognition of possibilities, transition to a fuller or better state, working with what we have and simply adding value for the benefactor's well-being. Growth means getting bigger while development means getting better – quantity versus quality (Maser, 1997). Sound development can be represented as a mode of improvement that preserves natural capital (Daly, 1996b) – enhancement in welfare without physical growth, progressive social betterment without growing beyond ecological carrying capacity.

A sustainable society is one that lives within the self-perpetuating limits of its environment. That society is not a "no growth" society. It is, rather a society that recognizes the limits of growth and looks for alternative means of improvement. In this way humanity can concentrate on developing its full potential instead of being distracted by unrealistic growth desires. In theory this should not be too difficult to envision. Each of us does much the same thing in the course of our individual lives. We grow early in life and when we reach adult maturity we develop mentally, socially, and culturally, instead of continuing to physically grow. Growth during adulthood is either obesity or cancer.



Additionally, in trying to get ahead, or as we say "grow," we often find ourselves in the unfortunate position of preventing our development from reaching its full potential by the patriarchal discrimination we attach to gender, race, class, religion, or ideology (Daly, 1996). Because of these disparities, in essence half of the world's population is in one way or another excluded from taking initiatives to contribute their skills and work toward the needs of the collective global society (Bernard and Young, 1997). If instead we could take full advantage of the potential co-development activities from all these different parts of humanity in solidarity, we might not feel so pressured to "keep growing" our economies.

Development can continue endlessly as we seek to improve the quality of life for humans and for the other creatures with which we share the planet. To fulfill these aspirations, we must recognize that

human development is not about having more, but about being more. It seems then that "more is better" is an inherently frustrating game – a game that has been promoted by the fallacy of confusing the quantity of things with quality of life; a game that now has too many losers and so few winners (Flint and Houser, 2001). The idea of development must be separated from an economic and reductionism dimension of life. If we think of development as assuring a dignified level of existence – that is serving human basic needs, such as food, safe water, shelter, clean air, clothes, friendship, diversity of tastes, beliefs, preferences, etc. – we would take a giant step toward constructing a better world: healthier, happier and less unequal. This shift in attitude and behavior is guaranteed to promote personal fulfillment and sharing, but will also reduce unfulfilling, unnecessary consumption. Through the actions of sustainable development, a new win-win scenario can be born.

Planting the Seed

The concept of sustainable development was first articulated by the World Conservation Strategy (IUCN, 1980). But not until the work of the Brundtland Commission did the idea of sustainability first reach the global stage (World Commission on Environment and Development (WCED), 1987) when this Commission attempted to address two difficult and apparently conflicting problems, as summarized by Gibson (2002).

1. Increasing environmental degradation on both spatial and temporal scales was leading not only to resource depletion and damage to essential ecological functions in specific situations, but also to cumulative global effects.
2. Failure of initiatives to attack poverty conditions in many places around the world was leaving large numbers of people in destitution and insecurity while the gap between rich and poor deepened.

Discussion by the Commission about these key global problems led to agreement that the concept of "sustainable development" could represent a means of approaching what on the surface appeared to be very different problems. The Brundtland Commission (WCED, 1987) set forth that "sustainable development is improving people's life-enabling habits to meet our needs in the present without compromising the ability of future generations to meet their needs." Natural resources such as water, air, soil, plants, and animals are the basic assets upon which all life, human and otherwise, depends. Therefore, according to the Brundtland definition it is unwise to use up these supplies, or we will be threatening the security of all people, in the present and future.

This vague definition, however, has proven to be open to a host of interpretations (Parris and Kates, 2003). Deeper examination of the phase shows that ***sustainable*** means an act is viable and can be continued (Woolf, 1975) over the long-term (*to keep something going*) without lessening the ability to support life, to comfort, to nourish, and to keep alive. The concept of sustainability applies to our jobs, our homes, our relationships with people (close and far-away), our health, our children, nature and the environment in which we live, the food we eat, commercial trade with other regions and countries, our

sources of energy and water, world peace, and any other concerns we confront on a daily basis. For all of human history, the Earth has sustained human beings by providing food, water, air, and shelter.

Development refers to the way in which the interaction between elements (such as the economy, society, and the environment) progress and change toward improving or bringing a situation to a more advanced state (Woolf, 1975), such as in our efforts to improve local/regional transportation or land-use. Development happens everywhere and affects everyone. The measure of successful development is that it is long-lasting without putting the well-being of nature or humans, including their social structure and economic support, at risk. But when people hear the words sustainable development together they often think it is in reference to the focus of international development and donor organizations through their work in third world regions, rather than applicable to <u>all</u> societies, cultures, and communities around the globe. In most instances the use of "sustainability" is probably less confusing when referring to a condition society is trying to achieve. Sustainable development would be used in reference to <u>actions</u> attempting to achieve sustainability objectives.

In trying to envision the big picture then, achieving **sustainability** suggests working to improve people's well-being (often equated to economic condition) without damaging or undermining society or the environment – development that provides real improvements in the quality of human life and at the same time conserves the vitality and diversity of the Earth's ecosystems. It is important, however, that we not concentrate on environmental concerns alone! Commitment to human and societal well-being is as vital as ecological commitment to the planet in promoting sustainability. We must preserve a planet fit to live on and also create institutions that sustain the quality of our socio-economic life. Thus, sustainability is the science of stability between humanity and the human habitat. For example, business is about both improving the well-being of consumers and the company's financial bottom-line (Burns, 2001). Business's degradation of the environment, natural resources, or social capacity does not improve well-being. Instead, well-being is improved by the development of business methods to minimize energy, material use, noxious emissions, and social impact per unit of economic activity.

Based upon the Brundtland Commission's assessment, sustainable development represents the parallel consideration of healthy environments, life, and human well-being. This includes issues of population, climate, economic prosperity, energy, natural resource use, waste management, biodiversity, watershed protection, technology, agriculture, safe water supplies, international security, politics, green building, sustainable cities, smart development, community/family relations, human values, etc. All these "pieces" are parts of the sustainable society puzzle, because they are the basic ingredients of everyday life. Sustainable development provides a multi-dimensional way of thinking about and acting upon the interdependencies among natural, social, and economic systems in our world that these puzzle pieces are part of. It represents a process in which economics, finance, trade, energy, agriculture, industry, community building, and all other policies are implemented in a way to bring about development that is economically, socially, and environmentally viable and healthy. And the ultimate goal is to meet the needs of the present without compromising the ability of future generations to meet their needs. Therefore, in practicing sustainability over the long-term (Flint and Houser, 2001) one will:

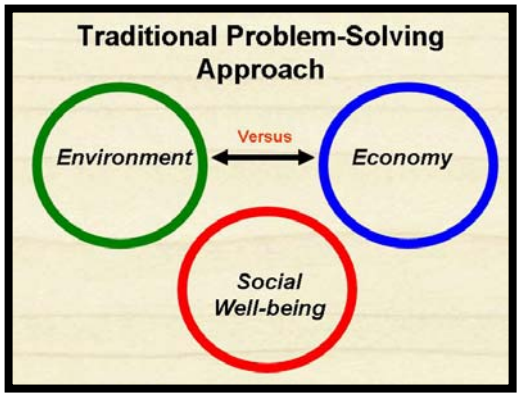
1. not diminish the quality of the present environment;

2. not critically reduce the availability of renewable resources;
3. take into consideration the value of non-renewable resources to future generations; and
4. not compromise the ability of other species, people in other places, or future generations to meet their needs.

Sustainability calls for improving the quality of life for all of the world's people far into the future (generations) without increasing the use of our natural resources beyond the Earth's twin capacities for regeneration (*e.g.*, trees and water) and waste absorption (*e.g.*, carbon dioxide and toxic chemicals). It represents progressive social betterment without growing beyond the ecological carrying capacity of the Earth. The conventional economic imperative to maximize production is accountable to an ecological imperative to protect the ecosphere, and a social equity imperative to minimize human suffering. This is the foundation of sustainability.

Sustainability's Triple Threat

The confusion about sustainable development and the inability to act sustainably in today's world is related to how the many variables that affect the way human beings live are perceived. These variables can be categorized into three major points of view: economic, social, and environmental (Flint and Danner, 2001). These points of view can be distinguished as the triple threat to sustainability because they are traditionally dealt with as separate, isolated sectors in our world. Each corresponds to a set of components that has its own distinct driving forces and objectives.



- The economic sector is geared mainly toward improving human welfare, primarily through the production and consumption of goods and services.
- The social sector emphasizes the enrichment of human relationships and achievement of individual and group ambitions.
- The environmental sector focuses on protecting the integrity (reliability) and resilience (flexibility, toughness, ability to recover from change) of ecological systems.

But these sectors of our world can not be separated when searching for sustainable solutions to our global problems, as has been the case in traditional problem-solving (*i.e.*, see the circle diagram above). And in many instances, as the dual-pointing arrow in the diagram above suggests, there are often conflicts between perceived socio-economic needs and environmental conservation objectives, as suggested in the popularly cited conflict of "jobs versus environment." The end objective of this traditional, piecemeal approach to problem solving is the "mitigation of adverse effects" (Hodge, 2004).

A new model of problem-solving must consider each point of view systematically and strategically, addressing primary concerns and how these relate to one another across the different points of view (Flint, 2004b). In other words, the success of any societal activity should be judged in terms of its contribution to human and ecosystem health together (Hodge, 2004). From this perspective, the concept of sustainable development is much more than environmental protection in disguise. This concept distinguishes between environmentalism, which so often focuses only on ecological integrity, and the sustainability movement, which is more holistic and inclusive (McDaniel, 2002). The seeking of sustainable solutions is going to require the consideration of relationships between:

1. **Economic concerns**, such as increasing resource needs due to population growth; growing income gaps between rich and poor sectors of society; and extreme poverty – about 3 billion people, roughly half the world's population, are estimated to earn less than $2/day.
2. **Social and human health concerns**, such as widespread exposures to trace levels of persistent, bio-accumulating, toxic substances; social disintegration resulting from displacement of traditional lifestyles; the lack of safe drinking water for approximately 1.5 billion people globally; unsanitary urban conditions where as many as 2 billion people lack access to sewers; lack of primary education for approximately 130 million children world-wide; and proliferation of both viral and bacterial infectious diseases.
3. **Environmental concerns**, such as the potential for climate change due to CO_2 and other global warming gases; degradation of air, water, and land in industrialized areas; depletion of natural resources, including freshwater, biomass, and minerals; loss of agricultural land due to deforestation and soil erosion; and threatened wildlife habitats, including forests, reefs, and wetlands.

Integrating these concerns through the application of sustainable development calls for both human and ecosystem well-being to be preserved or enhanced. Maintaining one at the expense of the other is not acceptable from a sustainability point of view, because in either circumstance the foundation of life is undermined (Hodge, 2004).

Norton (2005) provides some excellent examples of how considering problems in isolation, usually from an economic stand point, sooner or later can bring about changes on temporal and spatial scales that were unpredicted and also found to be undesirable – thus reference to the "triple threat" to sustainability. For example, successful development of an economic activity may be a sign that the design and planning were good in addressing a particular social need. But as Norton (2005) suggests it may also be a sign that we have not foreseen the longer-term consequences of the activity. He uses the story of Aldo Leopold to illustrate this point. Leopold suggested in the early 1900s that wolf and mountain lion populations be controlled in the Southwestern United States in order to provide more deer for hunters, significantly increasing the economic benefits from such activities. Unforeseen for many years, however, were the deteriorating aspects of the slow-changing arid physical systems that supported the deer populations prized by hunters. With time the deer populations that grew beyond the carrying capacity of the land because of lack of predators (wolves), overgrazed the vegetation on the

plains and mountainsides, undermining economic success in the long-run through the crash in deer population numbers from lack of food. In addition, the loss of vegetation on the mountainsides resulted in extensive erosion and flooding to communities many years after the realization of minor economic benefits from deer hunting.

The lesson from Leopold's story is that humans have the power and technology to be the dominant force on a landscape and therefore can't ignore the long-term consequences from trying to gain short-term economic benefits. In Leopold's case, he did not think about the long-term ecological impacts of his actions in wanting to produce large deer herds for hunters. He did not consider the nexus of environmental, social, and economic problems which can translate into a "triple threat" to sustainability. As Norton (2005) effectively illustrates "humans are not only actors on the short-term economic stage, but also are increasingly dominant players on an ecological scale, capable of accelerating ecological change by removing a species, which in turn can impact geological formations, such as a mountain." The lesson for Leopold was to distinguish the importance of multiple temporal scales and the associated hidden dynamics that drive them (Norton, 2005).

As suggested above, success in the short-term with regards to economic goals often overshadows triple threat issues that can set in motion both social and ecological processes undermining the foundation of a stable functioning environment. Unfortunate lessons we have learned from not considering the temporal scale implications of solving problems as well as the impacts across sectors that result from too narrow a view to taking action include the regrettable outcomes from acid rain, CFCs, dredged and reconstructed waterways, forest harvesting, DDT, oil and gas exploitation, and numerous other activities to enhance our economies.

Consider the example where all the land owners in a region simultaneously clear-cut their forested areas in response to the significantly increased market value of wood, a strong economic incentive (Norton, 2005). Once the land is cleared the community leaders believe the forest clear-cutting can be mediated by the development of an industrial park and retail stores on the cleared land, thus providing jobs not only for the present generation but also for those members of the community in the future. As Norton (2005) cites, "good investment has given the community a more mature, stable, and even more diverse economy" than taking a different forest harvesting strategy would have. The thinking is that people of future generations will be better off because they have more economic opportunities than a forest economy would offer them. But what about those people and communities harmed according to "non-economic criteria," the constraints placed on their future choices from loss of forested lands? For example, the loss of the forests can translate into global climate change effects over the long-term, as well as increased erosion, impacts on water storage and recycling, increased flood threats, and the loss of aesthetic appreciation a viable forest

ecosystem can provide many. People may have equal or better economic opportunities than their ancestors, but do they have more social and environmental benefits or opportunities?

The concept of a triple threat to sustainability also can play itself out on a spatial scale. Mayer, et al. (2005) describe geographic situations where the importing of forest harvest products by one country can result in the export of ecological impact to the countries supplying the timber. When a particular country promotes forest biodiversity and conservation while at the same time maintaining a significant demand for wood products, those products must be supplied through trade with others. In these instances the countries exporting timber products are not always able, or willing because of short-term economic gain, to promote similar policies of forest habitat conservation and biodiversity. Mayer, et al (2005) cite the example that increasing demand for both wood products and forest conservation in Asian (*i.e.* China) and European countries (*i.e.* Norway) has placed increasing pressure on forests in Russia.

Another example of socio-economic decisions playing out over a spatial scale comes from examining the fate of many persistent organic pollutants (POPs) in our world today. Through a process known as the "grasshopper effect," persistent chemicals can jump around, evaporating in warm conditions and then settling in cool spots (Flint and Houser, 2001). When the temperature is right, POPs will again take flight and continue hop-scotching travels that carry them anywhere and everywhere on Earth. Scientists detect them wherever they look in the world, even in regions where these synthetic chemicals have never been used. For example, the pesticide toxaphene, used to treat fire ant colonies and never applied further north than Texas, now contaminates fish in wilderness lakes in the Canadian Arctic. Persistent contaminants typical of industrial regions like the Great Lakes have been found in albatrosses on remote Midway Island in the middle of the Pacific (Auman, et al, 1997). The penguins in Antarctica have become contaminated with a breakdown product of the pesticide chlordane and other persistent chemicals.

Unfortunately, assistance programs intended to help communities in developing countries today often only worsen circumstances for the poorest of the poor because of their isolated focus on a single element or specific problem, opening the door for unanticipated triple threat outcomes. For example, well-intended projects to help communities in achieving access to clean water, thus alleviating many common diseases and causes of death (*e.g.*, Africa) in and of themselves **do not** move the community to a better quality of life over the long-term. Short-term solutions to public health issues lead to decreased mortality rates, resulting in higher population numbers in many of these rural, isolated communities. These increased numbers require more food and other basic utilities such as adequate housing. Solving problems of disease without dealing with added stresses on nutrition and housing will discount the potential positive outcomes of decreases in

disease alone (Pimentel and Morse, 2003). Placing emphasis on decreasing the death rate from disease contracted from unclean waters while not also taking steps to meet the needs of increasing populations from decreased death rates would greatly exacerbate a region's social and economic problems.

In an effort to provide needed income and alleviate poverty the Nigerian government developed the idea of promoting agriculture of cassava in rural communities. Without the concurrent development of markets, transportation systems, and/or storage capacities in these rural villages, however, the production of cassava will not translate into improved incomes for villagers. And if incomes were elevated from successful production of cassava, what would this increased income mean to villagers if they could not spend their money on for example, improved housing, because the materials and skills for building new homes do not exist in these villages? These questions were never part of the formula in initial programming.

Threats to societal and ecological well-being are woven together in mutually reinforcing ways (Gibson, 2002). If we can begin to judge proposed actions and policies for their economic value, as well as for their ecological and evolutionary affects, we will be following a model of sustainability by associating different human values (those wanting a strong economy and those valuing the natural environment) with the multiple dynamics of natural systems. Corrective actions must be woven together to have positive outcomes for multiple objectives and informative feedback for needed changes to stay on-track, in contrast to the carrying out of policy that is based solely on short-term economic benefits.

Thus, sustainable development involves the carrying out of activities that offer economic benefits in the present without negatively affecting social and environmental choices that are available to people in the future, or in other places. Unsustainable activities are those that do not consider the "triple threat" to more slowly changing system dynamics such as ecological function, and thus change what today might be viable opportunities into constraints sometime in the future. Sustainability is a strategy that fully considers the "triple threat" of economic, social, and environmental dynamics in a system context and acknowledges space-time relationships when making decisions that ultimately impact a complex, dynamic system (Norton, 2005).

Challenges to the Idea of Sustainability

Sustainable development is a dynamic set of actions which enables all people to realize their potential, meet their needs, and improve their quality of life in ways which simultaneously protect and enhance our Earth's life-support systems. These, however, are the main poles of tension. Social inequity, the material disparity in terms of needs not being met for all people, as well as the question of why

consideration for nature should come before the welfare of humans, are at the center of the sustainability debate (Flint and Houser, 2001).

Ecological sustainability is the simple part of the concept. While there is considerable debate over where exactly the limits are, there is general consensus that we must learn to live together within the means of nature. Socio-economic sustainability, however, is a more difficult and potentially contentious concept. Mainstream economists do not worry about shortages of natural resources to supply our needs and receive our wastes because classical economic theory assumes human resources can substitute for natural resources (Montague, 1998). There is considerable evidence now, as discussed earlier, that the use of natural capital by many parts of our economy has already exceeded the regenerative and absorptive capacity of the environment (Daly, 1996). In addition, the question of who gets what (and how) from increasingly limited economic production, especially with China now seeking developed world standards of living, raises the specter of potential conflict both within and between nations. The need for shared justice and the associated hidden potential for conflict from social injustices is the most scary and politically taxing part of the sustainability question.

In addition, sustainable development is not necessarily popular with the people who can most make a difference by understanding and carrying out its meaning. Problems come from two directions. First, it suggests unwanted sacrifices on the part of individuals craving to preserve the status quo. The meaning is unclear regarding the costs, benefits, and strategies of intergenerational sacrifice and transfers (Daly, 1992). Secondly, the full unfolding of sustainability involves patience and the ability to look to the future. In this regard, there are often not instantaneous gratifications from actions we might take to fix what's going wrong, thus discouraging further efforts. Immediate solutions are not always apparent for problems people face in dealing with daily struggles. As we get caught up in wanting immediate solutions, we unintentionally end up creating even more problems.

Another challenge to operationalizing sustainable development comes from its original definition. The World Commission on Environment and Development (1987) set forth that sustainable development is ensuring our actions today do not limit the range of environmental, social, and economic options open to future generations. The majority belief is that this statement offers no substance for those really wanting to implement actions that are believed to be sustainable (Marshall and Toffel, 2005). It also seriously brings into question what the idea of <u>needs</u> really means, as stated by the WCED (1987). How do we distinguish between essential needs today and wants – those that are supplementary or excessive? And likewise, how do we distinguish between the needs of very different cultures or people in the future compared to present-day society?

Basic human needs have been defined by Manfred Max-Neef (Lahiti, 1998) an economist from Chile. But because we can't predict the future our deliberations can only recognize that people do inevitably require what qualifies as the meeting of needs adequate for a respectable life (Gibson, 2002). As Norton (2005) states, the identifying of needs for future generations can realistically only go as far as maximizing their opportunities while minimizing their constraints by what we do in the present. Therefore, society is charged with using, developing, and protecting resources at a rate and in a manner (based on our state of technology and social organization) that enables all people to meet their current needs and also provides that future generations can meet their own needs (Daly, 1996), simultaneously fulfilling environmental, economic, and community requirements. It means keeping the consumption of renewable natural resources within the limits of their replenishment; living on the Earth's income

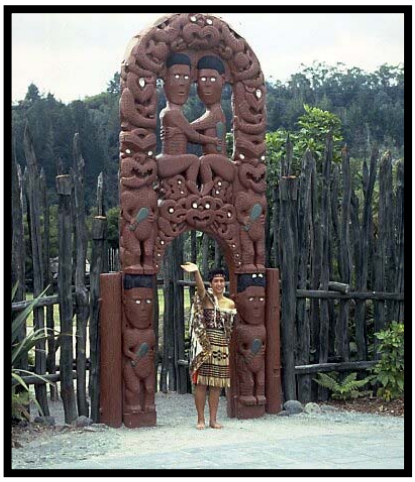
rather than eroding its natural capital (Patterson, 2000). And herein lays another problem: how often are we absolutely confident with regards to the limits of a resource?

Those devoted to some form of societal and ecological relief from for example potentially damaging consumption, chose to emphasize the idea of minimum effects – "sustainability can be achieved by actions that minimize damage to our natural environment" (WCED, 1987). Another, possibly less problematic description states that "sustainability can be represented by patterns of production and consumption continued indefinitely without causing irreparable (lasting; beyond repair) harm to the ecosystem services we rely upon for life" (Bartlett, 1998). Actions that will move society toward goals of sustainability must encourage positive steps (Gibson, 2002) and therefore the minimization of negative effects or avoiding irreparable harm is not sufficient. The complexity of natural systems limits our information and ability to gauge "minimal damage" or "irreparable harm," causing a certain degree of uncertainty with regards to scientific understanding, which then suggests the idea of precaution in the actions we take rather than the desire to "minimize" damage.

Many other critics feel the concept of sustainability is just too complicated to have any real meaning to either professionals or people in the general populous, and thus it does not provide a tangible foundation upon which to guide decision-making. There generally seems to be a lack of clarity in communicating what is truly meant by sustainable development. If ten people on the street, that might have actually heard the phrase "sustainable development," were asked what it means, seven different answers would likely be given (Flint and Houser, 2001). In addition, for everyone who has an understanding for some meaning of sustainability, there are probably ten times as many who do not, either because they are confused by the ideas of its theory, or they just don't trust its concepts. Likewise, numerous practitioners wanting to solve problems more immediately believe that "the big picture view" of sustainability is not specific enough for the problems facing them on a daily basis. They feel the need for activities that are more narrowly focused and target-oriented on their particular environmental, economic, or social worry (give me a quick fix!). Causing most concern is the fact that in many situations sustainability is perceived as addressing mainly environmental and conservation issues, focusing only on ecological integrity (Orr, 2002). This view completely misses the point that the sustainability movement is more holistic and inclusive, intended to address the integration of environmental, social, and economic dimensions in planning and action.

Because it is broadly based – cutting across all dimensions of human life, including such issues as energy shortages, species extinctions, pollution, disease, breakdown in families, armed conflict, child abuse, poverty, and corruption – sustainable development requires participation by all of society in moving beyond the conflicts of debate. And it requires authentic solidarity among individuals and groups where the mindset allows people to make decisions seeking a

fair balance between individual gain and the common good. The process must remain flexible, because what works in one community may not work in another or may work for different reasons. One size does not fit all!



The plethora of views and concerns has rigorously challenged the idea of sustainability and nearly rendered the term meaningless, severely distracting from the need to address the multi-dimensional nature of economic, social, and environmental issues (Gibson, 2006b). New learning approaches are called for to promote more debate in society about what sustainability is. Yet few are trained or experienced in these approaches.

For decisions and actions to be sustainable, they must be ever elastic, adaptable, and creative. You can plan and plan, but then also leave yourself open to mystery and discovery! We must always be receptive to the fact that economic development, equal social access and benefits, and environmental health are inextricably linked and connected. Therefore, the choices we make must simultaneously advance objectives in these different sectors in order to minimize unintended consequences (the 3 Cs of sustainability).

But without acceptance of a common philosophy related to what sustainability represents neither the general public nor scientists with significant expertise share a universal model for understanding and addressing issues. It is this lack of a shared conceptual model that prevents communication among different sectors of society and encourages disciplinary experts to "talk past" their counterparts from different disciplines (Norton, 2005). The absence of a shared understanding sets the stage for ideological thinking to dominate because there is no flexibility for testing reality. The lack of flexibility in discussion of sustainability often allows dogma to influence the debate, and leaves no room for learning from the experience of others or from testing certain ways of proceeding.

To make matters worse, ideological opponents can gravitate toward polarized theories of how benefits should be derived in socio-economic and environmental sectors to the point that dogmas can block communications and make agreement on common actions more difficult to achieve. Instead of experiencing this polarization, sustainability should be thought of as achieving economic health, environmental protection, and social equity objectives in an integrated, comprehensive way, as will be conceptualized in a later section. It is about equal consideration between economic development and environmental quality, between technological innovation and community stability, and between investment in people and investment in infrastructure.

A Conceptual Understanding for Sustainability Philosophy

Sustainability is often viewed as a slippery slope, something to avoid if possible because of feared conflict over differing points of view. This is quite obvious from the discussions above regarding challenges to the ideas of sustainable development. Uncertainties about the world around us, as well as the contradictions many of them pose, suggest why debates about sustainable development often are reduced so quickly into disputes about whether or not continued material growth and consumption are

feasible in what some perceive as a world with limited resources (Flint and Houser, 2001). But the actions of sustainable development are important because the situation of declining global resources and accumulating wastes in our world can only be corrected with persistent (perennial; long-lasting), multi-dimensional changes in global socio-economic patterns that move us toward long-term solidarity, security, and resilience (Hodge, 2004).

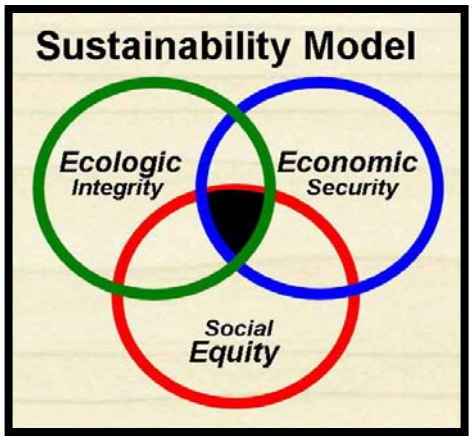
Persistent is used here because it is important to imply more than just maintaining the status quo, more than just preventing further degradation. Living systems are not static; they are continually unfolding into new forms (Maser, 1997; Jacobs, 2000). This means the consequences of our effects on the ecosphere don't die away. They will continue to resonate into the indefinite future. Our task ahead is to shape a sustainable future, using resources less intensively by combining social, economic and environmental strategies that produce opportunities and minimize constraints for future generations (Norton, 2005) and people in other places through the practice of sustainable development.

We must fully appreciate and relate to the environment's connection to our economic and social systems. Misleading answers to questions and ineffective solutions to problems will be the outcome by looking at any one of these parts of our world in isolation. Moving towards sustainability therefore demands better understanding of complex, intertwined, and dynamic conditions. Economic activity can promote a healthy environment and healthy ecosystems can enrich their inhabitants. These facts are easy to talk about, but as Gibson (2006b) notes it is extremely difficult to comprehend the complexity of the topic and take action with regards to the public view of issues and problems that often don't fit nicely into our traditional view of the world.

Therefore, it becomes important for us to take advantage of the power of conceptualizing (being able to visualize via diagrammatic illustrations) the theoretical underpinnings of sustainability as a foundation for supporting cross-cutting actions that will best serve beneficiaries. Sustainability is not a "thing we do" or a "program we carry-out." Instead, it is a concept, a model, by which we reason in a "world of linkages and interdependencies" (Gibson, 2002) and a way we choose to live; a theory that uses common sense and intuition as a baseline. Sustainability should be viewed as a philosophy, or ethic, affording people the ability to consider long-term consequences of actions and encouraging them to think broadly across issues, disciplines, and boundaries. This ethic can be promoted more confidently from visualizing and understanding the interconnections that sustainability implies.

As an attitude, sustainable development exposes citizens to the ramifications of their thoughts and actions on others, their local environment, and the surrounding landscape, as well as motivating and organizing people to direct change within the context of responsibility for future generations. This

attitude is more easily understood if it can be visualized in a conceptual framework. For example, much of the literature attempts to construct an understanding for sustainability by presenting its implications through the use of overlapping circles which reflect traditional modern disciplinary categories. Gibson (2002) illustrates how some practitioners promote a two circle version (ecological and socio-economic) while others prefer three circles (ecological, social, economic), or five (ecological, social, economic, cultural, political).



Here a conceptual diagram of three overlapping circles (see adjacent diagram) is used to help visualize the interconnectedness of modern humanity's economics within the dictates of its ecological and societal (human) bases of support, emphasizing that material gains alone are not adequate measure of human well-being (Gibson, 2002). In this illustration "cultural and political" categories are included in the social sector. And the societal sector emphasizes "equity," implying that fairness across the board is an absolute necessity to achieve sustainability.

In considering the three overlapping circle Sustainability Model shown above, it is important to clearly articulate what each of the three circles implies (Flint 2004b). The definition of these three sustainability elements (sectors) is:

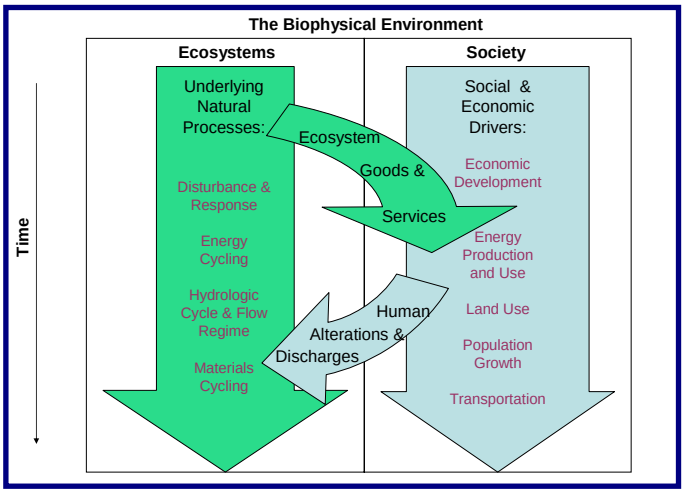
- Economic Security (*Compatible with Nature*) – development that protects and/or enhances natural resource quantities through improvements in management practices/policies, technology, efficiency, and changes in life-style.
- Social Equity (*Balancing the Playing Field*) – guaranteeing equal access to jobs (income), education, natural resources, and services for all people; total societal welfare; fairness to avoid conflicts.
- Ecologic Integrity (*Ecosystem Capacity*) – understanding natural system processes of landscapes, watersheds, and seas to guide design of sound economic development strategies that preserve these natural systems.

By this model we are guided to operate under the rubric of sustainable action in which any project that focuses its efforts with an intended sustainable outcome, means it strives to link economic, social, and environmental parts of the community to strengthen its overall fabric. This means carrying out actions that attempt to simultaneously address issues of ecologic integrity, economic security (viability), and social equity (Flint, 2004b), resulting in well-being for all parts of the community (darkened intersection of three circles in the adjacent diagram).Projects that focus upon only one of these elements are usually not good examples of efforts to achieve sustainability. All resources – human (social), natural, and economic – are interrelated, and therefore must be addressed in concert with one another. Each element of the overlapping circles diagram is interconnected to demonstrate the interaction between all parts of life and emphasize the need for their equal consideration. To isolate one from the others is not an accurate depiction of the processes of sustainable development and the values used to implement it.

Members of a sustainable community realize that long term economic security depends upon having a sound, functioning ecosystem and a healthy social environment that includes full public involvement. Therefore sustainable development represents a multiple sectoral way of thinking about the

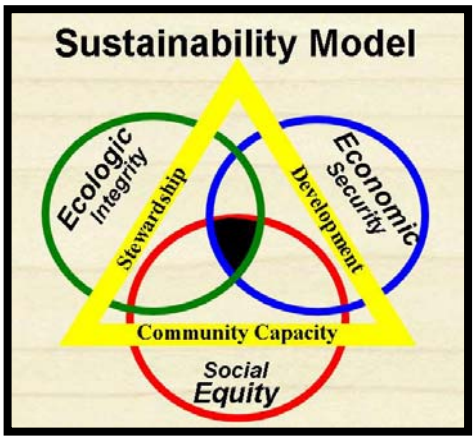
interdependencies among natural, social, and economic systems. Efforts to achieve economic vitality should occur in the context of the enhancement and preservation of ecological integrity, social well-being, and security. Sustainable development:

- involves policies, plans, and activities that improve equality of access to natural resources;
- recognizes that there are limits and boundaries of resource use beyond which ecosystem behavior might change in unanticipated ways;
- requires consideration of interactions occurring across different geographical ranges - global, national, regional, and local; and
- challenges us to look to the future and to fully assess and understand the implications of the decisions made today on the lives and livelihoods of future generations, as well as the natural ecosystems upon which they will rely.



To visualize the multi-sectoral relationships the adjacent diagram from Heintz (2004) illustrates that sustainability is a property of the biophysical environment that emerges from interactions between the ecosystem and society. Ecosystems include all living things on Earth and the non-living systems with which they interact and on which they depend. Society includes all the human elements of the biosphere. Humans are a part of nature, not apart from it. The economic system is a part of the social system.

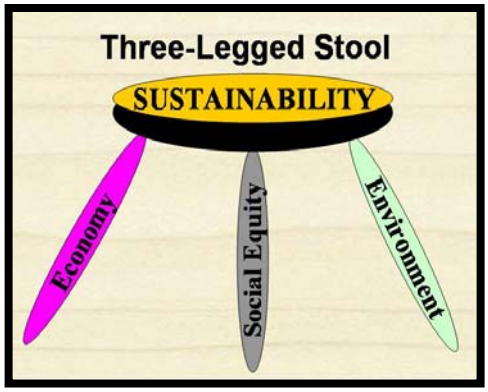
Once the overlap and integration of sustainability elements is identified, accepted, and used as a mode of operation in problem-solving design and implementation, people can begin working collectively, extending the area of overlap and integration demonstrated in the Sustainability Model (diagram above). The key to success of this strategy is that we always treat one another with dignity, compassion, and equality while we explore the hidden potential of the almond-shaped region of circle overlap and the progress to be gained from serious integration of the different issues that challenge us. This happens through solidarity. Socio-economic problems can be resolved only with the help of all the forms of solidarity: solidarity of the poor among themselves, between rich and poor, of workers among themselves, between employers and employees in a business, and among nations and peoples. International solidarity is a requirement of the moral order; world peace depends in part upon this.



If communities are focused on developing a more sustainable economy and doing it in a way that seeks equal consideration for modern society, economics, and nature (the three overlapping circle model above), then stakeholders will be guided by the community development triangle (shown in yellow in the adjacent diagram). According to this representation the **development** of economic security for a place requires consideration of equal opportunities for all, diversity of economic structure, and

environmentally sound production design to minimize economic leakage through the development of value-added processes and promotion of local consumption. The triangle also suggests an image of closely linked elements of **stewardship** to enhance a locale's ecology, natural resources, ecosystem services, and people. Furthermore, in order to achieve sound support mechanisms between development and stewardship, there must be a healthy foundation of **community capacity** upon which to enact identified actions, which includes strong leadership, full public involvement (civic critical mass), and collaborative decision-making and action. Without the triangle base, the sides of the triangle will fall down! Achieving sustainability involves connecting the sides of the triangle (Flint and Houser, 2001).

In this context sustainability, as implied by the three interconnected circles, not only embraces wisdom and stewardship in the management of natural resources, but also considers the responsibility of fulfilling basic human needs such as food, shelter, clothing, and the provision of economic means through which to achieve these needs for present generations, without compromising the ability of other species sharing our world or future generations to meet their own needs. In addition, the challenges humanity faces can only be met if people everywhere acquire an awareness of global interdependence. Then, as we identify with the larger world a sense of universal responsibility will follow suit with the awareness that things are entwined and must be acted on in concert as guided by the conceptualized understanding the above Sustainability Model provides.

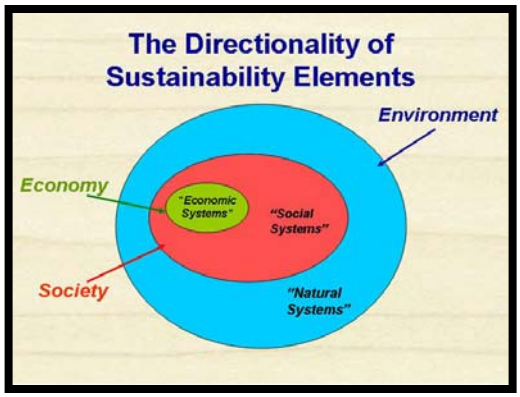


Another way of visualizing the integrative idea of sustainability is to consider a three-legged stool, where each leg respectively represents one of the basic elements – economic security, ecologic integrity, or social equity (see adjacent diagram). If one of the stool legs is removed, the stool falls over, emphasizing the importance of all three legs to maintaining the upright position of the stool – the importance of all three sectors to supporting the achievement of sustainability. The metaphor of the stool represents an easily imagined way of understanding how sustainability is built upon a foundation of equally considering and simultaneously acting upon these three sectors of our world.

In these portrayals of sustainability philosophy presentation of the circles implies areas, especially in their overlap, where damage must always be avoided and improvements always sought (Gibson, 2002). Thus, any strategy for sustainability will seek positive effects on ecological, social, and economic conditions over the long-term, preserving opportunities for and minimizing constraints on future generations (Norton, 2005). "Persistent negative effects in any one area mean that the potential for sustainability is being compromised" (Gibson, 2002).

Although it is true that all life depends on natural resources (Wackernagel and Rees, 1996) and that society is unavoidably dependent upon environmental conditions friendly to human life (Gibson, 2002), economy and society are no less important to humanity than ecology. There is no serious strategy for preserving and enhancing ecological integrity that does not also involve improving human well-being, both its social and economic elements, as we learned from the work of the Brundtland Commission (WCED, 1987). It would be absurd to care for the human habitat and not care for human beings. This overall relationship however, is most accurately depicted as a "directionality" of dependence (Flint, 2004a), where economic and cultural activities are integrated into natural processes

in a cyclic fashion so as not to degrade the environment upon which economic prosperity and social stability rest. This inevitable relationship between human cultures and the ecosphere can be depicted by a series of concentric circles – with the circle of economy inside the circle of society, which is in turn inside the circle of environment (see diagram below). As Gibson (2002) states, "this is not the dominant way of seeing the world in cultures where the economy appears to rule. But it is, arguably, the way things really are. The implication is that anything in the smaller circles that undermines the larger is weakening its own foundation."



As suggested by this diagram, the socio-economic spheres are inside of the ecosphere, which implies there is no economy outside of society, and no known socio-economic activity that is distinct from the surrounding environment. The totality of the human economy is measured by the total number of people multiplied by their resource consumption and waste. Thus, there is consistently a dependence of economic activity on human and natural resources (Daly, 1996). Think about it – we are the only inhabitants of the planet who have strained its resources so critically. Most species of plants and animals have built-in controls. They don't truly have an economy that they must continually grow. Their supply of food and habitat conditions limits their expansion, and if these become overburdened, their numbers suffer. Since most life forms are somewhere on the food chain, they often are rescued by predators that help to regulate their population (Jacobs, 2000).

Not so with humans! Human populations through history always tended to outgrow subsistence, so disease and famine in the past would even things out (Diamond, 2005). Technology and the growth of cities, however, have thwarted this pattern of balance. Ultimately our present population could become stable by increasing the death rate beyond the human birth rate. This seems to most people, however, to be an untenable solution! Instead, we must begin assuming the stance that humans will always be affected by their surrounding environment, natural or artificial. Thus, to act sustainably we must always consider environmental change, because in the co-evolution of human and natural systems, humans are directly related to and affected by the environment around them. Once we can visualize the directionality of the three circles, the philosophy of sustainability begins to become clearer and can enhance our integrated discussion of problems and design of solutions.

Consider the production of electricity in the context of the concentric hierarchy of circles above. In order to have a prosperous economy, society demands the continued and added production of electricity. In order for electricity to be produced to power our economies, society must develop the appropriate technologies, as well as regulate its demand for this electricity, in order to effectively use the supply of water (environmental issues) in a sustainable way for producing electricity. Electricity requires sources of cooling water in traditional fossil fuel power production plants and also requires the continuous supply of flowing water in hydropower production facilities. Thus, the directionality of this scenario is that our

economic ventures can not be driven by electricity if society does not provide the human capital resources and there are not adequate supplies of freshwater. In a feedback manner, the use of water as a natural resource for creating electricity requires that it not impair other users of that water, by the electrical production discharging pollution or in other ways degrading water as an output.

The existence of economies is based upon the existence of societies and their capacity to add value to natural resources. Furthermore, society cannot exist without an acceptable environment and the resources that environment provides for basic human needs (Gibson, 2002). This directionality is analogous to a three-stage rocket ship propelling or building and enhancing natural capital (environment) first, which powers human capital (society) second, and finally, propels financial capital (economy) through the engines of society and the environmental resources society adds value to (Maser, 1997). Consider that humanity – its economy and society – can't inhabit the moon independent of the Earth. The moon's environment will not allow it.

This conceptualization of sustainability's directionality across sectors or disciplines comes to the forefront when we consider all the media attention on world climate change and potential resulting dangerous economic and social impacts. If weather and global climate significantly change faster than life can adapt, major extinctions will occur, as when the dinosaurs disappeared from the Earth. Likewise, if changes in our environment affect our climate, evidence suggests these climate alterations could impact coastal cities with flooding and change the makeup of whole bio-regions around the world, directly affecting the economies and comforts of society.

Gibson (2006b) cautions that although sustainability is characterized (conceptually demonstrated above) as the "intersection of social, economic, and ecological interests and initiatives," when it comes down to people discussing and developing problem-solving approaches, policies are most often derived by addressing the three sectors separately and in isolation, which can result in unsustainable outcomes. In these instances he argues that the outcome actually ignores the interdependencies of social, economic, and ecological issues. Hopefully the visual images of sustainability theory presented here will lessen chances of this separatist view happening.

The brilliance of the sustainability movement is its demand for seeing things as interconnected and interdependent. As demonstrated by the conceptual frameworks above, the greatest power of the sustainability concept lies in its emphasis on integration – its ability to provide a bridge between disciplines and interests, between the pieces of the whole and the whole itself (Hodge, 2004). Traditional problem-solving has always fallen short in this regard. For societies to act sustainably, they must first be aware of what sustainability is and theoretically understand its intentions with regards to "looking for links and seeking mutually reinforcing gains" in all sectors (Gibson, 2006b). The image of sustainability characteristics presented above is a step in assisting humanity to identify a philosophy they can relate to. Once solidarity around this concept happens and these ideas are acceptable then, as described in following sections, other methodologies and packages of programming come into play to actually enhance the taking of actions that will move society toward goals of sustainability. But the acceptance of a philosophy or

ethic is the first step! In other words, sustainability is tightly coupled with solidarity. And this acceptance is made easier through visualization exercises.

Fundamental Truths

Armed with a conceptual understanding for sustainability theory we can proceed with added confidence to begin untangling systems in our work that are chaotic and complex (Patterson, 2000). We can try to understand how these systems operate but, because of significant scientific uncertainty, we can never be sure how they are going to behave as conditions change – leading to much debate about the meaning and implications of sustainability and criticism of the actions of institutions claiming devotion to it (Marshall and Toffel, 2005). Nevertheless, the diversity of theoretical ideas and applications that point to the need for sustainable development approaches is driven by a list of basic truths about how our world functions. How do we best use these truths to advance the concept of sustainability discussions where people represent different special interest groups or possess different experiences?

First, it is important to distinguish here between the meaning of truths and what we will discuss later, principles. The statement of a truth represents a reality in our world, a fact that is supported by scientific certainty, irrespective of whether it is natural, social, or economic science. A principle, on the other hand, represents a belief that forms the foundation of a fundamental doctrine (like sustainability) or serves as a rule, law, or assumption about the nature of a policy.

The work of Ferguson (2005) indicates why a common set of fundamental truths about sustainability can move society forward on a sustainability agenda. He suggests that the human brain might possess pathways that operate in a manner to inhibit logical faculties when a topic of discussion is contentious, like the diverse special interest groups and their discussion of sustainability, where persons have different pre-conceived opinions or the discussion subject goes against one's belief system. If this is the case then when the average person is presented with information about climate change, water shortages, natural resource declines, affects of population on global stability, pollution, energy problems, etc., there is ample reason to assume that active inhibition of a person's logic can be caused by heavily invested opinions, emotions, and belief systems (often in the form of dogma). As much as anything else this can arise from a feeling of self-preservation (avoiding hysteria) implying that these issues are somebody else's problem, not mine.

The possibility that human logic can be affected in this way does not bode well for sustainability advocates to convince the populace at large that our global situation has problems. Therefore it is important that we go back to the fundamental, non-refutable basis of why there **is** a sustainability crisis in today's world. The many examples of stressed natural resources and unstable human societies, in and of themselves, are viewed by many as doomsday paranoia that is unfounded because of ideologies or myths that are perceived as unsupported facts. To overcome this distorted view our conversation on sustainability has to be in touch with the basic truths that affect the foundation for a sustainable future – those facts that pull us back to the roots of the problem. After all,

facts you can cling to – emotions just float away. It is important the public at-large recognize these facts as irrefutable truths supported by our understanding of social, economic, and biophysical science. And these basic truths must be presented in a calm, peaceful, and emphatic way so that logic can prevail over pre-conceived opinions and emotional belief systems that are mostly false, but easier to live with. The fundamental truths that support the need for achievement of sustainability include the following.

1) **Everything material on Earth has limitations.**

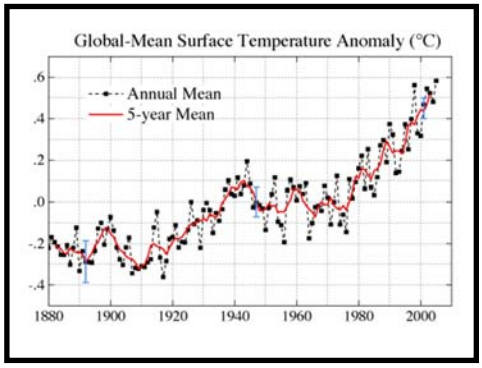
Earth is a closed system with regards to material cycling (Daly, 1996) such that there is a thermodynamic irreversibility of natural processes (1st law of thermodynamics - nothing is created nor destroyed, just transformed). Obviously Earth will not grow and therefore the size of things, such as population, matters. The closed nature of material cycling on Earth implies there are ecological limits on human activity that dictate we consume less than Earth's natural resources can provide (living within nature's limits) in order to maintain resource sustainability (Hawken, et al., 1999). Sustainability is about recognizing and working within these limits. This includes biophysical limits, such as the amount of productive land, as well as our limited ability to manage complex systems. Biophysical limits inspire a sense of urgency, since there is no way to renew some resources or find substitutes in a reasonable timeframe. Therefore, natural resources must be maintained in persistent conditions and not be stressed by over-consumption beyond irreversible states. And because the limits of many resources are unknown there must be continual awareness for the dynamic, constantly evolving, and often unpredictable properties of natural systems. Our limited abilities suggest that, rather than pursuing options based solely on science and technology, we need to be humble and direct most of our attention to understanding and managing ourselves while avoiding feelings of hopelessness and despair.

2) **Many components of our global system are interconnected.**

Problems in the economy, environment, and society are interrelated and global in context (Gibson, 2002), to the extent that human and ecological well-being are effectively interconnected by the nature of the planet's abiotic and biotic components which are intimately intertwined and systemic. Sustainability is a means of addressing these complex interconnections and interdependencies, such as issues that appear to be separate, like biodiversity conservation and social disparity. Actually these are linked by tangible, multi-dimensional factors that are relevant across a range of scales and interact through positive or negative feedbacks. Anticipated change in one aspect of life, such as increased personal income, might affect changes in other aspects, such as the demand for food and other resources, type of housing, ability to travel between home and work, and so on. Thus, planning to intervene independently in the operation of a given "sector" can be ineffective or cause undesirable results to other sectors. For example, life expectancy of people as they move through time is affected by water, sanitation, and health care. But, improving sanitation and access to clean water and reducing infant mortality might only increase the number of hungry and discontented people in an area, unless the ability to produce or buy more food and better housing is also increased. The objective of sustainability should not so much be focused upon specific interventions as wholeness

of actions. A systems approach is needed in taking account of the relationships between different aspects of life. (For more detail, see "A World of Interconnections" section of this manuscript)

3) **Change is the norm, not the exception.**



If we are to thrive in perpetuity, society and its economic systems must maintain a recurring, perpetual vigilance for change that is in harmony with the natural world. Nothing in our world is static. The dynamic, random pattern of natural processes maintains continual changing states of materials and energy (Maser, 1997). In carrying out actions intended to enhance society or protect the environment, because of the complexity and interdependent nature of these systems we must be concerned about the occurrence of unintended consequences from decision-making (Jacobs, 2000). In particular, if things change for the worse we must be sensitive to the irreversibility of those changes. Mistakes will be made so the resiliency of systems to significant change is extremely important. Resilience can be characterized as the amount of disturbance in economies, cultural relationships, and ecosystems that can be sustained before a change in its structure may occur from outside influences (Axelrod and Cohen, 1999).

4) **All socio-economic factors are grounded in a healthy environment imperative (directionality).**

Environment is the plumbing of the planet. Nature is our life-support. There is simply no way around this reality. Without functioning ecosystems nothing else matters. Only when we have a healthy natural environment, coupled with healthy social systems, can we truly prosper economically. We must be cognizant of achieving human well-being without exceeding the Earth's twin capacities for natural resource regeneration and waste absorption (Daly, 1996). Sustainability suggests working to improve people's economic condition without damaging or undermining society or the environment – development that provides real improvements in the quality of human life and at the same time conserves the vitality and diversity of the Earth. Thus, our economic desires/demands become accountable to an ecological imperative to protect the ecosphere and a social equity imperative to create equal access to resources and minimize human suffering. The interdependence of ecologic and socio-economic concerns requires a re-connection with nature – developing a profound understanding for the concepts of care that underpin long-term stewardship of the places we call home (Flint and Houser, 2001).

5) **Diversity within systems (natural or human) will contribute to the system's stability and resiliency (includes ecologic, economic, and socio-cultural diversity).**

The multi-faceted make-up of society and nature are both important to long-term stability and resilience. Species diversity in nature's ecosystems, with all its varied functions, is one of the more important variables to sustaining the quality of the natural environment (Rees and Wackernagel,

1994) because of effects on biological community production, the stability of the ecosystem, its resilience (ability to resist change), and the effective production of ecosystem services vital to people. In high biodiversity situations the failure of one species does not necessarily mean a system's collapse because another species can probably assume the same ecosystem functions as the disappearing species. The same can be said for a particular culture, a form of economy, or a human civilization in history. A sustainable human community possesses a healthy and diverse economy (variety of businesses, industries, and institutions which are environmentally sound) that adapts to change, provides long-term material security to residents, and respects ecological limits by maximizing income generation while also maintaining or increasing the assortment of natural assets (redundancy) that yield benefits (Jacobs, 2000). For example, the greater the number and variety of businesses in a community, the more immune that community will be to economic decline from one business failure. Likewise, a healthy human community is characterized as one that supports people of different cultures and ethnicities to offer a wide variety of social experiences (Bernard and Young, 1997). How able are our socio-economic and ecologic systems to develop systemic ways of responding to changes which can safeguard the community from failure? Resilience in human communities as well as natural ecosystems is dictated by the state of diversity and redundancy represented in different community characteristics or species' functions, in the context of a "complex system." Because of their interdependencies, economic policies and the maintenance of ecological integrity need to focus on developing resilience to external economic or ecological shocks. Diversity is the backbone of resiliency in nature. In addition, sustainable human communities develop resiliency strategies that price goods and services to reflect the full social and environmental costs of their provision and link area businesses, products and services, and resources and customers to increase the recycling of money and other resources that will remain in the community. A sustainable community is one that respects and preserves the many different cultural attributes developed over its history and truly commits to the idea of resiliency when it considers impacts on the community 175 years from the present (the Native American seven generation test).

6) Equity is the foundation of healthy functioning systems.

Social equity is the second most important foundation element of sustainable societies, for without equal access to resources, opportunities, and good environments envy and/or conflict will prevail among those who have and those who have not. Social equity implies that diverse social, cultural, and ecological systems are preserved and that tensions are able to be resolved by distributing costs and benefits equitably (Bryant and Mohai, 1992), creating a sense of fairness. Even in nature there is fairness among species in the form of competition processes that will ultimately lead to "survival of the fittest." Failure to protect the biophysical environment threatens all people in the future and compromises the ability of many people in less competitive circumstances in the present (WCED, 1987). With

regards to people in the present, most basically, as Robert (2002) states "the bounty of the Earth – food, raw materials, natural systems – must be used equitably, fairly and efficiently so that the basic needs of all humans are met locally and globally." Many communities around the world, however, face continuous constraints on their access to materials and economic opportunities, such that their means of making a livelihood and security are in constant peril. This disparity and the associated disproportionate impacts it exerts on different societies has resulted in the degradation of ecological resources as well as the potential for conflict, often growing into circumstances of war and terrorism (Lash, 2001).

7) **Uncertainty and ignorance are often associated with complex systems.**
There should be a general recognition that science and knowledge are intrinsically uncertain, with new information continually altering our perceptions and beliefs. Therefore, decisions based on scientific information must be made in the context of uncertainty (Norton, 2005), but with the recognition that further experimentation and monitoring could lead to more certain outcomes through learning-based management (*e.g.*, adaptive management). And of most concern is the fact that lack of public familiarity with scientific methods hinders a ready translation of science into personal choices (Bernard and Young, 1997). In order to deal with uncertainty and protect against unintended consequences, we must have appreciation for the precautionary principle (Gibson, 2002). For more detail on the precautionary principle, see the "Tools to Consider in Sustainability Practice" section of this manuscript.

The above fundamental (basic) truths that promote the need for considering sustainability must become a part of normal public conversation in an effort to develop global solidarity in support of sustainable development. These realities in our world are the reasons concern for sustainability has become a global phenomenon. By promoting the discussion of these general areas of strong consensus we can influence constituencies with vastly different viewpoints to focus upon facts they can commonly agree to because these truths are irrefutable according to scientific understanding for the way nature and society function. Using these areas of strong consensus as a starting point, it becomes much easier to have a dialogue about problems related to environmental and socio-economic sustainability, using these basic truths for guidance, especially when the true concerns of society are often messy and cross the traditional boundaries of economic, social, and environmental interests.

A World of Interconnections

How often do we really consider all of nature's interconnections in the web of life? As Willow Thomas has said: "When we coat everything with black tar and plastic we become more and more removed from the little kingdoms and their dance that support our lives, and which are vital to life of all kind." Everything is related to everything else is an accurate proclamation! As the Academy Award nominated actress, Marsha Mason, states, "life on our planet depends on an interpenetrating web of natural systems. No part of the natural world is independent of the others" (Mason, 2006). All that we do and expect in our world is predicated on the idea that everything is interconnected – the Earth,

planets, wind, water, seeds, insects, even rocks, human beings, and all other creatures of Earth. Everything must be respected in a holistic view of our world. Thus, in considering the idea of creating a sustainable world, the following basic assumptions warrant consideration:

(1) everything, including humans and non-humans, is interconnected, interdependent, and interactive;
(2) the whole is greater than the sum of its parts; and
(3) nature determines the limitations of human endeavors.

Global climate change should remind us that people, the economy, and the environment are perplexingly linked. No human desires can be fulfilled without some connection to the environment. A common human notion, however, is that nature is assembled like a machine, acts like a machine, and thus can be treated like a machine, made up of parts not necessarily related or interconnected (Maser, 1997). The end result of such a mechanistic approach most often comes down to misunderstanding interactions in the environment and then miscalculation in efforts to protect against or remedy environmental damage.

Achieving a sustainable world depends on a full understanding of the connections between ecosystems and human well-being, as well as the drivers and responders to change (Carpenter, et al., 2006). For example, Darwin was a guy who asked lots of questions and looked intently at the kingdoms around him. Long ago he hypothesized that English cat lovers might unwittingly be setting off an ecological domino chain effect that led to prettier gardens. Cats eat mice that normally pillage the nests of bumblebees, so Darwin reasoned that more cats would mean more bees – and more of the red clover and purple-and-gold pansies that bees pollinate – thus, the more cats, the prettier the gardens in a district.

Kelp Forests, Sea Lions & Killer Whales: Consider the intriguing, complex story of declining kelp forests that one way or another feed a range of species from barnacles to bald eagles or provide habitat in the Alaskan coastal Pacific Ocean (Estes, et al., 1998). The disappearance of massive kelp beds caused governments and conservationists to hypothesize that pollution and other man-made disturbances were culprits. It turned out not to be that simple. In recent years, diminishing food supply has caused Pacific sea lion and seal populations to decline. They are a preferred prey of killer whales, but as their numbers decreased, whales began preying on sea otters that live in the giant kelp forests along the Pacific coast. The sea otters prey on sea urchins, which in turn are a major consumer of kelp. As a consequence of the whales switching to sea otters for food, otter populations decreased and their feeding was no longer able to keep the urchin population in check. Now the kelp has been overgrazed by the urchins to the degree that the massive underwater forests are disappearing.

Caterpillars, Tree Farms & AIDS: In another example described by Chris Maser (1997), the day-flying moth *Urania flugens*, found in Mexico and South America, metamorphoses from a caterpillar that feeds exclusively on a particular variety of trees and vines known as Omphalea. The heavy defoliation caused by the feeding of the caterpillars causes the plants to produce a protective chemical

toxin unpalatable to the moths. This plant-produced toxic compound has been found to be effective against the AIDS virus in test-tube experiments. But there is a problem. The toxin is produced only when a plant interacts with a large population of caterpillars. The timber industry, in cutting down much of the forest, simplifies the structure of the forest, essentially converting it into a tree farm and minimizing the capacity of the moth to reproduce. Such simplification removes interactive, interconnected, interdependent functions on which long-term stability and adaptability depend.

Acorns, Mice & Gypsy Moths: A team of researchers studied connections among white-footed mice, ticks, gypsy moths, deer, and Lyme disease (Jones, et al., 1998). They found that in upstate New York forests in years when there was an overabundance of acorns, there were also booms in the mice population because they eat acorns. Mice also eat the gypsy moth larvae found in tree nests. When acorns were abundant, the mice were abundant and kept the gypsy moth populations in check, eliminating their threat to eastern U.S. forests. But white-footed mice carry in their blood the Lyme disease spirochete which they transmit to tick larvae from the forest floor. When there is an over-abundance of acorn production, tick-bearing deer are also attracted. The adult ticks on the deer that gather in larger than usual numbers spawn more larval offspring which infest more mice, and thus more ticks pick up the Lyme disease vector. So while the damage of the gypsy moth is being kept in check by one series of ecological mechanisms (mice feeding), the dreaded Lyme disease has the potential to proliferate.

Shearwaters, Climate Change & Over-fishing: Scientists have labored to untangle the web of life in the Bering Sea, a major marine system providing food for many humans. Some strange, new kinks have them wondering just what the web ought to look like (Saar, 2000). A sea bird, the Short-tailed Shearwater, migrates every year from Australia to the Bering Sea, its prime feeding grounds. In recent years, Shearwaters by the hundreds of thousands have been found dead. The link between climate change and the Bering Sea ecosystem is especially strong. Ice limits the growth of small aquatic plants that feed the rest of the food web, and changes in wind dynamics have altered the patterns of ice cover and rate of ice melting in the spring. Nutrients from deep water nourish the aquatic plants and allow them to produce enough food for all their consumers, such as small shrimp-like animals, but when the ice melts in spring and winds are not sufficient to mix deeper, nutrient rich waters with surface waters, the plants do not become abundant enough to feed the small shrimp-like animals. The food web shifts as the shrimp disappear. The shrimp happen to be the preferred food of the Shearwater, and what at first looked like a toxin or predator problem now is revealed to be a far more complex food supply problem. The highly productive fishery area of the Bering Sea, which supports many international economies, is being assaulted from both top and bottom. Fishing and hunting are taking out marine predators, while climate changes are reshaping the community of tiny marine plants and animals that sustain life-forms higher in the food chain.

Mangrove Forests and Human Welfare: This is a two-pronged story that is intricately connected. It is becoming more common in developing countries that because of the massive decline in oceanic fisheries as a food source, aquaculture is beginning to form a vital food supply, especially for many poorer countries. Aquaculture as one of the fastest growing sectors of the world food economy, increasing by 11% per year (Lazaroff, 2001). For example, shrimp farming now produces half of all internationally traded shrimp. Raising 800,000 metric tones world-wide each year, for a total value of U.S. $6 billion, the industry was predicted to generate benefits for cash strapped countries. And because many of the target species for culture are in demand even by people in the developed world, there is increasing pressure for the marine culture of fish and shellfish in coastal environments. But those interconnections just keep showing up!

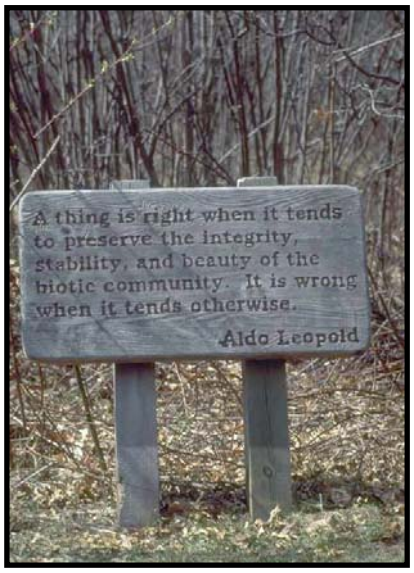
Although the intent of increasing food supplies is a noble one, developing intensive mariculture farms in coastal areas have also impacted environments, degraded habitats, and effected local livelihoods. Impacts have included the destruction of mangroves and wetlands, the large scale capture of wild larvae and brood stock, pollution, use of chemicals and antibiotics, intensive fish meal demands, and the privatization of public resources. Shrimp framing in particular has resulted in increasing poverty and landlessness, declining food security, and the breakdown of traditional livelihood systems in the developing world. The fury of the 2004 Tsunami in some Asian countries was magnified in areas with degraded coastal ecosystems, which most often translated into degraded or lost mangrove coverage (Stone, 2006). Mangrove forests shelter wildlife, serve as source of food, herbs, and firewood, and act as a buffer against wind and waves from coastal storms. Clearance for settlements and conversion to shrimp farms are major reasons for declines. Much of the Asian destruction in 2004 from the tsunami was the cumulative effect of decades of neglect and bad policies related to coastal habitat protection (*i.e.*, mangrove forests) that the tsunami brought into sharp focus.

The examples of interconnections just keep appearing! Nature and people are endlessly and inescapably under the influence of one another through connecting relationships. Working within the framework of these interconnections is the essence of sustainability. In a sustainable system, conservation, stability, and quality are valued along with production, development, and quantity. And this awareness must extend to the living and working conditions of workers and their families, the needs of our communities, and the need to be a good neighbor in the global community. People wanting to achieve a sustainable lifestyle must rely on the most informed understanding possible of the environment around them, commitment and love of home place, and the identification of long-term economic interests — needs, not wants — for establishing workable limits within nature's way. Establishing limits based upon awareness for interconnections and understanding the effectiveness of these limits constitutes the true practice of sustainable lifestyle.

A Simple Interpretation of Sustainability to Proceed

Sustainable development represents the taking of actions to define our problems and solve them in a way that is long-lasting. The combining of economic and environmental considerations in planning and implementing strategies, however, is what seems to create difficulty and cause confusion, resulting

in unsustainable actions. We must search for ways to be more open and flexible, examining our capacities to create co-action while doing no harm to the life-giving environmental elements that sustain the future of people (Gibson, 2002). Considering the undeniable truths listed above that cause us to think about sustainability in the first place, is a good way to begin the process, getting everyone on the "same page."



Acting sustainably is about re-connection with nature, copying what nature does (McDonough and Braungart, 1998), and developing a profound understanding for the concepts of care that underpin long-term ecologic, social, and economic stewardship of the places we call home. In its simplest terms, sustainability means not turning resources into waste faster than nature can turn waste back into resources and securing people's quality of life by maintaining an adequate advantage for these processes of nature (Wackernagel and Rees, 1996). It boils down to this: **don't eat your seed corn**. A time-tested concept, sustainability highlights the need to build replenishing systems that can supply the present without compromising the future.

Just how this is to be accomplished in light of continuing increasing global population numbers has been and continues to be a matter of debate and commands attention 20 years after the Brundtland Commission called for sustainable development, because many signs that alarmed the Commissioners back in 1987 are still with us and now other new global concerns have also grabbed our attention. Very simply, sustainability is about **people** – how to foster a robust workforce and strong communities. Sustainability addresses **innovation** – how to spark it, nurture it, and protect it so the idea pipelines don't run dry. Sustainability can be a lens to focus on **values** – inspired by faith, family, personal commitment – on the built environment and on markets. And, of course, sustainability is also about **natural resources** – how to use, renew, and account for environmental capital.

In envisioning how to move forward there appears to be a real gap in awareness about what sustainable development is and the urgency of addressing it. Practicing sustainable development is broadly characterized by the integration of information from a number of different disciplines. Thus, developing a comfortable understanding for sustainability can often be messy, especially at the grassroots level where community values do not usually fit nicely into disciplinary boxes. Without commitment to a full understanding for the interdependent and linked nature of most issues of sustainability (Flint, 2004b), as visually implied by the three-legged stool and overlapping circles conceptual models discussed previously and the interconnections highlighted above, one may find themselves adopting a discipline approach to planning and implementation (often associated with activities that wrongly focus on each of the three overlapping circles, one-at-a-time) with the hope these disciplinary elements will magically come together at some point. This kind of analysis can cause attention to focus on competing objectives, rather than on needs and opportunities for positive advancement of interrelated human and ecological interests (Gibson, 2006b).

An alternative is to not become bogged-down with a disciplinary approach. Instead begin developing a simply stated concept of sustainability that most can agree with. Then establish a community-based set

of principles that integrate information characterizing human understandings, relationships, and activities, that will actually move across the traditional sector boundaries (Gibson, 2002) that must be integrated to successfully address sustainability issues.

Beyond the uncertainties that fuel this debate, to develop a simply stated concept for sustainability we need to think about and discuss the things that are important to our way of life in our communities and affect our core values: such things as our homes, our children, our jobs, nature, where our water comes from, the air we breathe, and the food we eat. These topics are what sustainability is really about, especially with regards to posterity, and believe it or not they are interconnected. Although variations in understanding sustainability may occur, a number of basic concepts almost always come to mind, including:

- awareness of the multi-dimensional impacts of any decision (broadly categorized as economic, environmental, and social);
- the need for harmony and solidarity among the different dimensions across sectors, themes, and scales of place and time; and
- concern for the well-being of future generations.

Amongst any group of people with competing interests, however, you rarely would observe agreement on a formal definition for sustainability. Everyone sees the world through their own pair of glasses and these glasses often present different views. Dialogue will always cause special interests to surface. To overcome the obstacles in agreement created by these special interests people need to begin by talking about the simple things they agree upon. The essence of sustainability therefore, is to take the contextual features of economy, society, and environment – the uncertainty, the multiple competing values, and the distrust among various interest groups – as givens and go on to design a process that guides concerned groups to seek out and ask the right questions that will help them progress through incremental improvements toward common goals despite challenges (Norton, 2005). This process should be characterized by features that include: flexibility; diversity and stability (ecologic, economic, socio-cultural); respect for other people's dignity; consideration of unintended consequences (change is the norm, not the exception); and notions of enoughness and reversibility. When not hindered by a definition for sustainability that has been derived someplace else and used in the context of "one-size-fits-all," community deliberations are free to consider many different concerns, including their own social values that will affect the opportunities of people in other places and future generations.

By employing a form of hierarchical analysis, where we

1. acknowledge the standard and responsibilities established for a sustainable society by the work of the Brundtland Commission,
2. recognize the short-comings of and challenges to the World Commission on Environment and Development (1987) definition for sustainable development,
3. agree on a set of fundamental truths that influence us to look for alternative lifestyles,
4. decide to holistically address the diversity of these irrefutable truths by developing a sustainability "philosophy" that promotes solidarity on the interdependent, linked nature of

sustainability thinking and action through images that visually demonstrate these characteristics, and

5. then formulate a simple, schematic definition for sustainability,

we can realign our perceptions of socio-economic and ecologic systems with what we, as society, really think is important. Then we can begin to see how community-based deliberations freed of ideology and preconceived notions, can cut through most fact-value dichotomies (Norton, 2005). This can be assisted through the inputs of mission-oriented science where scientists, policy-makers, and the public are all fully engaged in a form a "citizen science" that engages the expert-way-of-knowing with the public-way-of-knowing.

This hierarchical analysis, to truly establish the values important to a particular community through their own dialogue and struggle for agreement, must be developed from the bottom-up. In this way the community can avoid the trappings of trying to work with a one-size-fits-all sustainability definition conceived somewhere else. The hierarchical analysis will promote a community's solidarity around a simplistic definition of sustainability. This simple, or as Norton (2205) suggests, "schematic," definition of sustainability can be turned into specifics by real communities of people that choose important criteria and indicators based upon their particular values. So the details of a particular community's sustainability criterion will have to be filled in by the community itself, in the process of choosing goals, priorities, and indicators in an open, deliberative, and democratic process (Norton, 2005). No definition from someplace else could include or dictate all of the locally driven value choices.

So what would a simple, graphic definition of sustainability look like for a community embarking upon this journey? We really have no way of knowing what the "needs of future generations" might be, as they are highlighted in the Brundtland Commission's definition, which has left it fairly useless from an operational perspective. As defined by the dictionary, however, sustainability implies a relationship among generations. And the nature of this relationship is such that the actions of the present to fulfill their wants and needs do not destroy or close off important and valued choices for generations in the future (Norton, 2005).

But in today's globalized society people in other places are just as likely to be impacted from the actions of particular parts of society, as are future generations. Sustainability is thus most basically acceptance of responsibility by people in a place and time for impacts of our sometimes violent actions on other places and the future. It is unlikely that all would attain such a perfect state but it presents a level to try and achieve in terms of taking the whole idea of caring about people in other places and in the future right into the marketplace. In practice, however, to this point in time this duty has often been relegated to a very low priority.

Large-scale actions, in and of themselves, or combinations of actions by individuals or a particular community, usually related to some short-term economic prospect, can irreversibly change the many opportunities and constraints provided by much more slowly evolving natural resource conditions (Norton, 2005). Living sustainably is maintaining the important mix of options and opportunities while creating no new and onerous constraints; living unsustainably is losing them, narrowing the range of options that people in other places or subsequent generations can choose among in their attempt to adapt, survive, and prosper.

Instead of attempting to understand the potential needs of the future, present societal members should instead be concerned about making sure that the opportunities they have to achieve their own values, the things important to them, are not in any way constrained for other places or the future by actions they might take. To hold open options requires the complicated and difficult process of a community attempting to conscientiously specify what obligations toward people in other places and the future it accepts, which require protection of the stuff so designated as long as present society's costs are bearable, and to compare those ideals its members would like to project into the future with the very real and present needs of people in the present generation (Norton, 2005). The communities themselves are responsible for choosing what is important to monitor and what is important to protect, not inhibited by some kind of sustainability definition established somewhere else.

Can a culture survive for many generations with current practices and institutions? Each generation has an obligation to regulate the long-term impacts of its activities (Norton, 2005). "An action or a policy is not sustainable if it will reduce the ratio of opportunities to constraints on people in the future" (Norton, 2005). If individuals fulfill their needs in such a way as to destroy important options, for example individuals in earlier generations over-consume and do not create new opportunities, then they will have changed the environment that subsequent generations encounter, leaving more constraints and reduced opportunities, making survival more difficult. When we state a set of ideals (values) for what we want our community to be like in the future, we identify those options and opportunities that give meaning to life in a place (Norton, 2005). "Important options" represent a variable to be specified as particular communities articulate their values and decide what is important to save for posterity.

Thus, interpreting sustainability as simply as possible in order to move forward with cooperative planning and action is to see sustainability as a function of the degree to which members of society will not carry-on actions that decrease opportunities or increase constraints, in comparison to present conditions, for people in other places or in the future (Norton, 2005). And how do we achieve this aspiration? Sustainable futures are not clear in advance but must evolve from a program of participatory social experimentation and learning (Norton, 2005). And this process must encourage the connection of scientific information with cherished human values (Norton, 2005). Sustainability includes both a descriptive component – it says something about what will be left for people of the future – and an evaluative component – it expresses moral concern about whether our legacy is fair to future people (Norton, 2005). Therefore, communities must be willing to learn from experience and accept the initial uncertainty of situations in order to move toward sustainability. We can use the "schematic" understanding of sustainability as suggested by Norton (2005) and apply the process of adaptive management, described later in this manuscript. In this way a community will set approximate goals and adjust them as new information comes in from science-based measurement and management experiments.

What Sustainability Is and Is Not!

With the amount of focus on sustainability these days, it is a good idea to make clear what it is and as importantly, what it is not. Sustainable development is not walking a tight rope, seeking some mythical balance between economics and environment (Bernard and Young, 1997). This leads to habitats half protected, economies weakened, and personal principles bargained away.

The primary characteristics of unsustainable behavior include:

- lack of understanding for human's connection with nature;
- economic deprivation;
- concentration of money (in a few hands) and an imbalance of power;
- an economy driven by profits at any cost, by greed, by consumption;
- communities competing with one another for jobs;
- inaccurate perceptions of others;
- lack of accountability in government, in corporations, and in individual behavior;
- placing blame "out there" rather than accepting responsibility at home;
- barriers between work, home, play – *e.g.*, physical separation, sprawl, and isolation;
- lack of trust in "the other;" and
- conflicting goals, strategies, and analyses.

To some sustainable development is maintaining the status quo – "keeping things going" in some state which they presently exist. Sustainability has been co-opted by organizations that are deeply vested in maintaining the status quo. Corporate policies that call for "sustainable economic growth" are a prime example. While some small economies may increase in size with insignificant consequences, sustainability is not about unbridled economic expansion, especially where our impacts are already causing social and ecological stresses. Maintaining the status quo is not what sustainability is about!

To mistake sustainable development for environmental conservation, or vice versa, is also not helpful if we really want to be sustainable. Concerns around protecting or conserving the environment could be regarded as working to make it sustainable. This focus only on the environment, however, is not always effective. All too often sustainability is equated directly with environmentalism and the belief that advocates want to protect the environment at all costs, including people's jobs and general societal well-being. In contrast, advances in our scientific knowledge on a global basis have led us to the understanding that environmental, economic, and even social issues are more interdependent than we realized. No matter what it might be that we as humans' desire, consume, or appreciate in our socio-economic world, it has an origin from environmental resources. Therefore, other areas of our lives and our planet need to be included in the sustainability discussion. If we are acting sustainably from a broader, system-wide perspective the environment is preserved.

Achieving sustainability is also not merely about a series of technical fixes, about re-designing humanity or re-engineering nature, in our continuing desire to compete in the global economy. Even the best technologies, policies, and regulations will not put society on a sustainable course without a

fundamental shift in our thinking and actions, along with extensive engagement of all global citizens. We can assume technology might eventually find a replacement for a disappearing valuable natural resource, but what if that particular natural product is the only thing that can cure a child's disease?

Likewise, the transference of a problem from one place or media (*e.g.*, air, land, or water) to another is not a sustainable solution. Much attention today is paid to the idea of "carbon trading" (also known as pollution trading) where one industry might be allowed to produce more CO_2 by paying another industry to produce less of this greenhouse gas. This transference violates a basic premise of most sustainability meanings; that we lessen our total impact on environmental resources. We are not lessening the impact in a situation like this, but instead simply moving the impact from one place to another. The idea of pollution trading also goes against concepts of sustainability requiring we consider trans-boundary and cumulative impacts on the different sectors in our decision-making processes.

We have been less than sustainable to-date and maybe some now feel guilty about this. The upside is that we have the power to make changes, to make sure that we do not lose too much more from here on. Ours is a world that does have limitations and what we now have left we really do need. But, sustainability is not a trend or phase or even a conditioned pattern. It is not a state in which a compromise (some win; some lose) can be struck. To be sustainable requires ultimate agreement, solidarity, on everybody's part (everybody is a winner). Only partially implementing sustainable development defeats sustainability altogether. Like two sides of a coin, solidarity and sustainability are tightly coupled. Sustainability is solidarity inside out. There can be no sustainability without a social order guided by solidarity. There can be no authentic solidarity without seeking sustainability. Likewise, leave one process out of the equation, or in some other way alter a connection between important economic and environmental or social elements, and the system as a whole will gradually be deflected toward an outcome other than that which was originally intended.

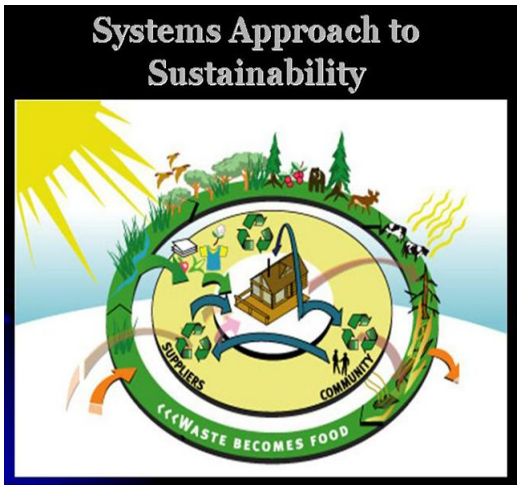
Sustainability is most fundamentally equity over time and place, making sure we consume less than Earth's natural resources can provide. Economic development (the foundation of today's globalization pattern) that is sustainable must be both environmentally sound and shared fairly among all societal members. Members of a sustainable community promote development that is ecologically regenerative, socially stable, economically prosperous, and politically peaceful. Sustainability is about monitoring how we relate to our physical and social worlds and, in many cases, reducing the scope of our economic activities (ecological footprint) to ensure the well-being of current and future generations (Wackernagel and Rees, 1996).

Sustainability is more a philosophy than an actual scientific concept – a philosophy that is guided by scientific understanding. It's the focus for a new debate about the shape of the future, a signpost pointing to a general direction that we must take while the debate is carried on about the best path forward (Gibson, 2002), based upon sound science.

Sustainability is **anthropocentric**, with a sharp focus on interpreting and regarding the world in terms of human values and experiences. In contrast, animals don't think about sustainability, they just do what they know. But, sustainability must be approached by humans from an ecocentric perspective, where ecosystem health is a primary concern, because only with health can we sustain conditions and circumstances that foster the well-being of our species. In other words, people must view themselves as part of the ecosystem. This perspective applies to all people everywhere, and draws heavily on science, ecological economics, and ecological psychology, but acknowledges that other points of view are equally valid (*e.g.*, religious). It requires that we respect different "ways of knowing" when focusing on world views that support various attitudes and actions because they shed light on how people relate to the world around them, what has meaning for them, and their beliefs about what lies within and beyond their control.

Sustainability involves planning for the well-being of future generations by **reflecting on the past**. A useful timeframe involves planning for the next three generations by reviewing what conditions were like over the previous three, and how those people adapted. Society can learn from human history on Earth by close examination of lessons learned from all the past civilizations that did not succeed, in particular looking at social and technological changes at the global level with an emphasis on the last 200 years.

At the heart of an 'integrated' or 'holistic' approach that characterizes sustainability is a determination to understand and take account of the relationships between different aspects of life through a systems approach (see diagram). The socio-economic, cultural, environmental, and physical development of any place comprises a complex set of relationships between different factors. These interrelations need to be fully understood before the nature of any intervention can be determined. For example, in considering strategies to reduce poverty there are several dimensions that require attention.



- We want to sustain communities as good places to live, that offer economic as well as other opportunities to their inhabitants.
- We want to sustain the values of society – things like individual liberty and democracy.
- We want to sustain the biodiversity of the natural environment, both for the contribution that it makes to the quality of human life and for its own inherent value.
- We want to sustain the ability of natural systems to provide life-supporting "services" that are rarely counted by economists, but which are estimated to be worth nearly as much as total gross human economic product.

If we recognize sustainability as the capacity of humans to harmoniously coexist in a manner that maintains wildlife, wildlands, decent environments, social equality, cultural freedom, economic well-being, and national security today and for future generations, then we must acknowledge that sustainable development is not only a scientific and technical challenge: it must also be approached as a moral/ethical question. In this way, sustainability encourages a re-connection with nature, developing a profound understanding for the concepts of care that underpin long-term stewardship of

the places we call home, offering people an ability to fully appreciate the environment's relationship to our economic and social systems.

Spirituality and Sustainability

As we are increasingly realizing in our world of growing populations, escalating greenhouse gases, and incessant loss of plants and animals through extinction, our technologically manipulative, consumer-based lifestyles can no longer continue at present paces. The concern for sustainability of humans as well as the natural world as we know it gives reason for question regarding the forces presently causing significant changes on the Earth and where the greatest influence can be leveraged to affect this change in positive ways.

Spiritual Awareness to Promote Sustainability and Solidarity: In order to encourage the public at large to begin holistically embracing the advancement of sustainability thinking and action, it is vital to emphasize the things that are important to humans in their everyday lives. People usually care about how others perceive them and judge them. They will likely show a great deal of concern for the ethical, fair, and sincere ways they conduct their lives, achieving their desires and intentions. This moral spirit that people show can be tapped into in order to draw attention to and enhance advocacy for sustainability by encouraging people to think with their hearts as well as their minds (Orr, 2002). By doing so we acknowledge that seeking sustainability is not strictly a problem of science or engineering or economics or proper management. It is all of these, and also includes the passion found in the values, ethics, and cultural heritage of people. Scientific data, laws, and economic incentives are not enough. Protecting the environment and global society is inescapably a moral issue as well. For example, Orr (2002) says with regards to sustainable development, there is more to understanding than is contained in the knowledge of physics, chemistry, and biology. There is also the wisdom of popular religious figures (*i.e.*, Jesus or Buddha). By enhancing our spiritual awareness the traditional impulse to manage nature based upon all our scientific capacities and governance abilities is balanced by the "humility of collaborating with nature, which is at the heart of sustainable design" (McDaniel, 2002).

How best can we go about influencing present mindsets away from greed and domination through the maximization of short-term, unsustainable benefits, toward actions that assure the long-term viability of the human habitat, which includes all Earth's ecosystems? The sustainability movement can gain strength from a core belief in the human capacity for goodness by drawing connections between for example, our current consumer behaviors and our religious and/or spiritual beliefs. Orr (2002) reaffirms what Sagoff (1997) was quoted as saying earlier in this manuscript: "the transition to a sustainable future is inevitable." The choice is it can occur "catastrophically or peacefully." The tipping point for a more acceptable transition

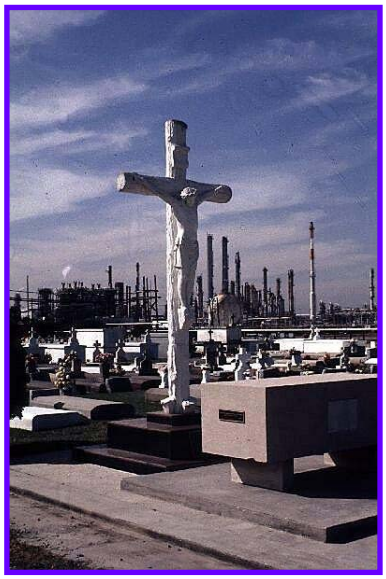
comes from an enhanced public spiritual awareness, gained for example through processes of meditation, prayer, acts of goodness to others, gardening, etc. (McDaniel, 2002). These practices can assist in transforming societal desires and intentions, influenced by this spiritual awareness, lessening the chance that transition to sustainability will be violent, paralyzing, and empty of meaning (McDaniel, 2002).

Basically sustainability is the science of stability between humanity and the human habitat, which includes all ecosystems of the world. And sustainability is tightly coupled with solidarity – the mindset that allows people to make decisions seeking a fair allocation between individual gain and the common good (Gutierrez, 2005). For example, it would be illogical to care for human beings and not to care for the ecosystems which humans inhabit. Socio-economic concerns and related environmental problems can only be resolved with the help of sound decision-making influenced by all forms of solidarity. Decisions and actions guided by a mindset of excessive consumption, wealth accumulation, and extreme concentration of power will only exacerbate unsustainable trends globally. In contrast, decisions and actions guided by a shared morality within society that includes limited consumption, nonviolence, and ego-less collaboration, can ultimately have the effect of reversing unsustainable trends (Gutierrez, 2005). Thus, there can be no sustainability without a social order guided by shared aims. And this shared aim or solidarity comes from the human morality philosophy promoted by one's own spirituality or relationship to one of many different religions and their basic beliefs.

It should be fully understood that this enhanced spiritual awareness does not presume one needs to be affiliated with or believe in a certain religion. A person can affirm the higher forces of wisdom and goodness without necessarily believing in a god or aligning with a church. For example, many environmental activists and advocates find themselves in this state. They think of themselves as spiritual but not religious as being accountable to god or a particular religion (McDaniel, 2002).

The combined forces of sustainable development advocates and people embracing spiritual beliefs can help shift unsustainable patterns. Cultures are increasingly good at creating consumers but fall short in efforts at creating citizens. On the other hand, religious groups as an example have a powerful opportunity to empower their large followings with religious teachings that warn of excessive materialism. These concerns prompted some 3,500 Lutheran, Presbyterian, Catholic, Unitarian, and Quaker congregations to establish the Interfaith Coffee Program, which encourages individuals and institutions to switch to coffee that is traded fairly. The congregations have partnered with Equal Exchange, a worker owned cooperative that sells fairly traded coffee from small-scale farmer co-ops in Latin America, Asia and Africa. There is also ample opportunity for religious groups to use their significant financial clout to push corporations to change their behaviors. A recent campaign led by a broad coalition of religious organizations linked fuel efficiency to morality and gathered a wealth of coverage through its "What Would Jesus Drive?" advertisements. In addition, a group of religious orders recently filed shareholder resolutions with Ford and General Motors to try and get those companies to build more fuel efficient and alternative energy vehicles.

Nature, God and Societal Wants: As demonstrated by the above examples, one's ethical attitude or religion can provide potential means for humanity to think about sustainability, but the many interrelationships among nature, God, and societal rule have become more complex and confusing in the modern world. All three are important components of the human dialogue but they allow for historical understandings to be rearranged by the needs and wants of present-day society, as well as by the ability of humans to significantly affect the world around them.



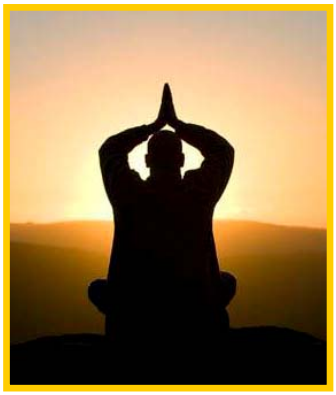
Christian scripture and many religious traditions affirm that all of the Earth community is valuable to God, who continues to create, sustain, and redeem the whole. God relates directly to and cares for the well-being of otherkind, created to enjoy being in their own right and not only to function as companions or helpers of humankind. But our expansion of scientific and technological understanding coupled with the movement of Christian and other religious traditions away from biblical teachings about the limiting conditions of life, the intricate and interdependent relationships between humankind and the rest of nature, and the benevolent, just acceptance for theological and biological facts of human kinship with all other creatures has caused Christianity in modern times to lose interest in the revelatory power of the natural world and has set humanity above nature in a manipulative, polluting, unsustainable way of life. The faith of consumerism has developed its own form of devotion – the will to mastery (McDaniel, 2002).

American culture for example, by its major movement away from what Christian theology offers in moral lifestyle guidance, plays a key role in cultural and ecological malformations by giving momentum to the rational, scientific conquest of nature that is proving unsustainable. Now it must be this same Christian theology that encourages humans to again embrace sustainable lifestyles. Exploring the full range of challenges to sustainability offers an invitation to seek an alternative to the consumerism will to mastery (McDaniel, 2002). Orr (2002) suggests that spiritual renewal is a way to replace the need for domination and control with an embracing of moral beliefs and openness to mystery. Our capacity to realize goodness through our practices and citizenship in the world should utilize knowledge gained from contemporary biophysical sciences and foster social morality concerned with reducing consumption and adopting habits of sustainability while encouraging the positive responsibility of government to protect the commons, preserve biodiversity, advance human environmental rights, curtail polluting technologies, and limit urban development and population growth.

This goal is not insurmountable. Spirituality, whether from a formal religious background or simply from one's moral convictions, is concerned most about pastoral care and social justice. Pastoral care means the work involved or the situation which exists when one person assumes responsibility for the well-being of another. This includes the provision of spiritual advice and support, education, counseling, medical care, and financial assistance in times of need. Interestingly this mission opens the door for the idea that apart from a doctrine-centered and rule-based notion of spirituality, there is a notion of "faith development"

found in a variety of religions (Walker, 2006). This faith development involves moving beyond the self and seeking "to act in the world in a way that increases the total well-being of the rest of the world" – in other words, acceptance of responsibility by people in a place and time for impacts of our sometimes violent actions on other places and the future. As noted earlier, this is a basic foundational principle of sustainability.

Spiritual thinking can also derive fresh insights from new reflections on the Bible that include an ecological awareness for understanding it contextually in light of contemporary science, archeological findings, and sociological methods of explanation to uncover its hidden treasure. This new view can dispel an overlay of modern anthropocentric interpretation, exposing how much scripture has to offer as a guiding resource for life with not only other humans but the rest of nature. Consider for example, pigeons, humans, aquifers, apartment buildings, rain forests, stubborn camels, and stars — specifically, the structural interdependence and interconnectedness of all. "Inter" is today's buzzword for us because it is the necessary qualifier for everything that touches both sustainability and religion: interrelatedness, interdisciplinary, intercontinental, intergenerational, interracial, intercultural, interspecies, interfaith — all interdependent, all interconnected. No man – or woman – is an island, especially in the age of the Internet.



Actually the origin of the word religion is so utterly fundamental and simple that it surprises many people. It comes from the Latin verb *religare* – which means to connect, to join together, to assemble, to create connectedness, to create community. Being religious therefore means being inclusive, perhaps even being compulsive about the idea that no one, indeed nothing in Heaven or on Earth, is left out. This primary "action" definition of religion as "connecting" offers a real foundation for sustainability thinking in contrast to defining religion as simply believing such-and-such. "Connecting" is the more ancient meaning of religion as community-building and maintenance – getting all the people together, keeping them together, and celebrating enormous togetherness. The point is to celebrate diversity in religious practices in the same way we celebrate the unique gifts that different trees bring to the forest and thereby save us from missing the forest for the trees, or vice versa. Religion and ecology both deal with individual persons and individual trees but always in the context of connecting the whole creation, the whole forest.

In addition, most religious traditions and institutions have always declared that humanity has a duty of stewardship toward nature and natural resources. These natural resources are a gift of God to humanity, and it is the moral duty of each human generation to preserve this gift for future generations (Gutierrez, 2005). This emphasizes human obligations in every place and pursuit, which express respect and care for Earth as God's creation and life's home, while seeking justice for bio-diverse otherkind as well as humankind. Thus, eco-justice, a spiritually-grounded moral posture (Hessel, 1998), offers a dynamic framework for thought and action that fosters ecological integrity with socio-economic justice through constructive human responses serving both environmental health and social equity. Hessel (1998)

suggests the four basic norms of eco-justice ethics include:

- solidarity with other people and creatures — companions, allies, victims — in the Earth community, reflecting a deep respect for creation;
- ecological sustainability — environmentally sound habits of living and working that enable life to flourish and utilize ecologically and socially appropriate technology;
- sufficiency as a standard of organized sharing, requiring basic floors and definite ceilings for equitable or "fair" consumption; and
- socially-just participation in decisions about how to obtain sustenance and to manage community life for the good of the commons.

These norms illuminate a biblically-informed imperative to pursue in reinforcing ways what is both ecologically fitting (based upon our knowledge of science and technology) and socially just (based upon our moral views). Solidarity comprehends the full dimension of the Earth community and of inter-human obligations. Sustainability gives high visibility to ecological integrity and wise behavior throughout the resource-use cycle. The third and fourth norms express the requirements of distributive and participatory justice – a primary building block of sustainability – in a world that has reached or is exceeding resource consumption, pollution, and population limits. From this perspective sustainability and the science supporting sustainable lifestyles, can more easily be integrated into Christian theology and individual ethics because it intersects, rather than competes, with human rights struggles for racial, gender, and economic justice.

Spiritual and moral attitudes can promote sustainable actions by the way people buy-in to changing their own destinies – where mercy and social justice opportunities meet in an effort to create a more sustainable world for the disadvantaged. This becomes clear from the "business as usual" way the developed world addresses disaster responses in underdeveloped countries. For example, as Fr. Jim Harbaugh a Seattle (WA) parish priest recently stated, it is one thing to be merciful and offer someone that is parched a drink of water (a quick fix to a much larger problem). It is another thing to acknowledge the need for social justice in seeing to it that the person and their community have the understanding and technology to provide a continuous, clean source of water to meet all their future thirstiness (requiring buy-in from the community to make it happen). In international disaster aid programs assisting governments usually take the merciful approach of providing that drink of water to the thirsty, or that sack of rice to the hungry. But they don't consistently assist the world's poor through science and technology in the just as important step of seeing that the disproportionately impacted are able to eventually provide their own water and food. Sustainability informs spirituality by the way a merciful act of providing a drink of water or a meal of rice, is turned into a long-lasting impact by integrating that morally-driven first step with the effort to scientifically and technically address equality in providing the means for the poor to be able to supply their own clean water and food without assistance from elsewhere eventually.

The Problem of Creation Versus Evolution: Obstacles to the union among scientists who provide evidence calling for human sustainable behaviors and religious communities who offer the moral under-pining to society for embracing sustainability actions exist however, in the significantly different

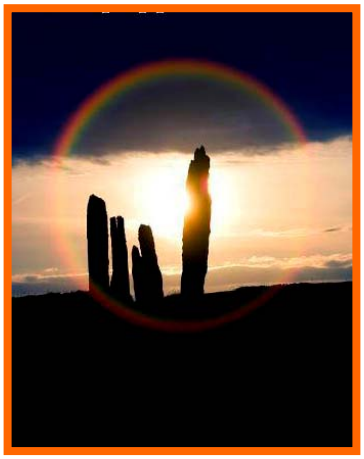
views regarding creationism and evolution which cause serious conflict and distrust between the two camps. These barriers must be resolved in order to gain full buy-in by the religious communities to the support for sustainability needs that science brings to the table. In essence, the theological and biological fact of human kinship with all other creatures can be advanced while reflecting a deep respect for creation. As Pulitzer Prize-winning author E.O. Wilson (2006) states, "science and environmentalism are linked in the minds of many with evolution, Darwin, and secularism. But to protect the beauty of Earth and of its prodigious variety of life forms should be a common goal, regardless of differences in our metaphysical beliefs."

For ages there has been conflict between ideas of creation (the religious view of our world coming into being) and evolution (the secular view of our world coming into being). The Christian interprets the Bible and its articulation of creation as the literal word of God. The scientist believes in evolution. As Wilson (2006) states, "the religion proponent may be wrong; the scientist may be wrong; or they may both be partly right." Religious and scientific communities must find some common ground that will build a trust between the two so that combined messages of scientific urgency and moral obligation can more effectively connect to advance the idea of sustainability at the grassroots level. And in fact, there may be a way of overcoming these obstacles if an alternative to the two views of our world coming into being is considered that attempts to integrate some of the meaning of each belief's premise.

Jane Jacobs (2000) consistently refers to the coincidences that exist in our world and the need to pay attention to those coincidences in our decision-making about what paths we chose to follow in our life-long journey. A coincidence represents the occurrence of events that happen at the same time by accident but seem to have some connection. For example, Redfield (1993) firmly believes that there are events that occur in our lives as part of a much broader swirling of occurrences that we are but tiny aspects of and yet have no comprehension how it all comes together and where we fit in to the scheme of it all. And in the larger context of ecology, Jacobs (2000) believes an ecosystem makes itself up as it goes along, shaped by happenstance events and its organisms' adjustments to them (involving development and co-development of species). For example using the animal kingdom, Jacobs describes the scenario of a hungry lion wandering the Serengeti Plains for a long period of time before it encounters prey. The coincidence of this encounter is important and if the lion does not act appropriately it faces potential starvation. If the lion survives its genetic make-up strengthens the breed. Similarly, humans must pay attention to the coincidences in their lives and chose accordingly to potentially leave a better world for future generations (basic premise of sustainability). Not paying attention to the coincidences leaves less chance for positive change. And those in the human world as well as those in the animal world, because of their inherent nature, when paying attention to the coincidences will probably survive (propagating their species and its genetic make-up), creating more viable populations. Isn't this the idea of Darwin's evolution theory?

As E.O. Wilson asks, is it absolutely absurd to "accept the possibility that there is some kind of (supreme) intelligent force beyond our current understanding?" And if this superior intelligent force were to exist, is it responsible for pushing the right buttons, creating the coincidences in life, to make

things happen on Earth that can lead to the evolutionary strengthening of all life – evolution occurs but it is guided by a supernatural intelligence? Now this does not necessarily contradict the religious view of creation in that God created the water, land, air, plants, animals, and humans, only in a different time-frame. Imagine readers of the bible through millennia trying to comprehend the idea that God created all of these things in a sequence not of days but rather in billions of years? The authors of the bible after all were men, and they might have believed that billions of years was beyond the understanding of the average bible reader, and therefore interpreted the story of creation over 7 days. If God as a superior intelligent force were presenting the array of coincidences throughout the history of Earth that by the choices of the most intelligent and strongest, or just luckiest, created what we observe today in terms of all Earth's characteristics, is this really that much different than the Bible's rendition of what God did in 7 days?



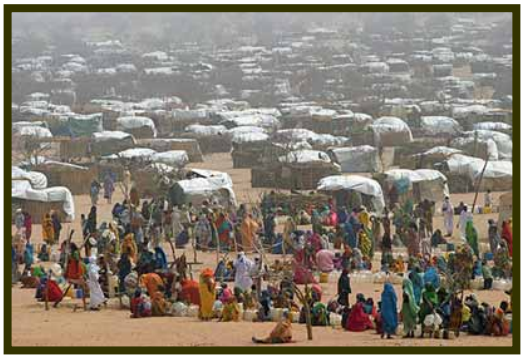
If one were to accept this form of logic, then there is room for both the belief of creation and the belief of evolution in shaping our world. And creation continues today as all forms of life encounter coincidences and act in ways that lead to survival and new forms of life. The Creation, whether you believe it was placed on this planet by a single act of God or accept the scientific evidence that it evolved autonomously during billions of years, is the greatest heritage, other than the reasoning mind itself, ever provided to humanity (Wilson, 2006). As a global society united by the linkage of sustainability and solidarity therefore, long-term human welfare is at the center of our thought. However the tensions eventually play out between opposing worldviews (creation versus evolution), however science and religion wax and wane in the minds of men, there remains the Earthborn, yet transcendental, obligation we as an interconnected society are morally bound to share and protect. Morality and science must come together in the promotion of more sustainable lifestyles.

<u>Cooperation Among Different Faiths and Sustainable Action</u>: Another challenge to integrating spirituality and sustainability comes from the fact that religious assemblages and cultural groups concerned with environmental, social, and economic sustainability have not always been the closest of allies. We continually observe through the various interactions and conflicts among different ethnicities and religions globally that communities generally have a history they demand respect for and thus try to preserve the many different cultural attributes of that history for the sake of their perceived resiliency. Problems among cultures and religions can arise when there is an atmosphere of disrespect among groups during interactions.

Within the past decade, however, organizations and individuals concerned with global sustainability and religious assemblages have started to work together. The exact cause of this increased cooperation is hard to pin down, but the growing visibility of issues such as climate change, species extinction, rampant consumerism, and areas of extreme poverty also being important global biodiversity regions are all factors influencing the shift. There is ample logic for sustainability advocates and religious groups to join forces on some issues, as both view the world in moral terms where nature has value above simple economics. Moreover, the two groups have complementary strengths. Sustainability advocates concerned about long-term global health bring strong scientific and policy backgrounds to the table, and religious groups offer strong moral authority, the capacity to shape worldviews, and large followings as well as financial leverage and social capital. The benefits of cooperation between the two, where sustainability science advocates and religious communities equally embrace their central tenets, can vastly improve progress toward a sustainable society.

In reality religions might be the only effective counterparts to greed and the unsustainable ideology of continued growth. Why? Because most religions are characterized by being based upon compassion and they think and deal over generations, centuries and millenniums – not only over a few years in order to be re-elected (like government officials). Religions have global presence, are accepted by people of all walks of life and education, possess age-old traditions and experiences, and offer some independence of material goods. Religion's chance, challenge and duty today is to give clear guidance concerning sustainability or responsibility for the creation and to demand solidarity as a means to that end.

Environmental sustainability initiatives from religious groups are indeed happening, proving successful, and they are occurring throughout the world and across denominations. Indeed, more than 70 percent of people of faith polled recently by the Pew Foundation believed global warming is occurring. Contemporary problems are receiving disciplined reflection among Christian ethicists who find their and other world religions to be accountable for failing to address environmental racism and injustice, human-induced climate change, unsustainable development and resource use, and the realities of the population-consumption explosion (Daly and Cobb, 1994). In response, churches are beginning to foster Earth-keeping habits or ecologically just patterns of ecclesial and social practice – encompassing liturgy, lifestyle, work, leisure and politics – to meet the deepening challenge of long-term global socio-economic and environmental health concerns.



Eco-friendly attitudes have increasingly moved into the mainstream of many faiths as religious communities become more active, especially on environmental sustainability issues that include energy-saving and energy-education projects described as "creation care." For example, during the past six years the Ecumenical Patriarch Bartholomew, the symbolic leader of the 250 million

member Orthodox Church has pulled together scientists, journalists and religious leaders for four week long symposia focusing on water related environmental issues. In 2002, the Patriarch led a symposium on the environmental threats to the Adriatic Sea that ended with a declaration on environmental protection jointly signed by the Patriarch and Pope John Paul II. In the summer of 2006 Bartholomew led another high-profile group of religious leaders, scientists, and activists on a trip to examine the interplay of faith and ecology involving a week-long voyage along the Amazon. There is also the work of Buddhist monks to stop deforestation in Thailand as well as lobbying work by the World Council of Churches to mitigate climate change. These conservation efforts clearly benefit from the moral authority of the religious leaders involved and are energizing some of the liveliest theological explorations in recent years with fresh studies and interpretation of Scripture along ecological lines. It is turning out that global environmental change and its implications for socio-economic sustainability are bringing a sense of urgency and shared purpose that few other issues can bring because this topic cuts across many religious traditions.

A very good example of a union between world groups concerned about environmental and social justice issues and the Catholic Church was the vision of Pope John Paul II in promoting the Church's strong support for water as a common good of humanity and the continued public, not private, overall control of water supplies. The Vatican's position was set out in a note by the President of the Pontifical Council on Justice and Peace, Archbishop Renato Martino, submitted to the World Water Forum on March 22, 2003. Entitled *Water, An Essential Element for Life*, Archbishop Martino's Note said, "Water is a common good of humankind. This is the basis for cooperation toward a water policy that gives priority to persons living in poverty and those living in areas endowed with fewer resources. The centrality of the human person must be foremost in any consideration of the issues of water," the Note continued. "For water users living in poverty this is rapidly becoming an issue crucial for life and, in the broad sense of the concept, a right to life issue. The principle of the universal destination of the goods of creation confirms that people and countries, including future generations, have the right to fundamental access to those goods which are necessary for their development. The few, with the means to control, cannot destroy or exhaust this resource, which is destined for the use of all. Powerful international interests, public and private, must adapt their agendas to serve human needs rather than dominate them." These statements by Pope John Paul II in 2003 come as close to the universally accepted definitions of sustainability as anything proposed by governments around the world.

Principles That Can Guide Sustainable Actions

Sustainability deals with complex issues, but the concept itself is straightforward. Statements about its meaning include:

- satisfying lives for all within the means of nature – now and in the future;
- understanding the thermodynamic irreversibility of natural processes;
- a way of acting that limits the destruction or loss of natural, manufactured, social, and human capital;
- a way of thinking about the vitality and unpredictable behavior of social and ecological systems;
- a pressure aimed at personal, institutional, and cultural responsibility;

- a social, environmental, economic, and spiritual trajectory that not only has to be developed (or re-discovered) but constantly reinforced.

Relying upon the underlying, basic truths coupled with a conceptual understanding for how the elements of our world interconnect, sustainable development provides a multi-dimensional way to achieve recovery and improve the quality of life for everyone. **But how?** Acting sustainably implies concurrently limiting waste and pollution, improving the status of disadvantaged peoples, conserving natural resources, making valuable connections among groups, promoting cooperation and efficiency, and developing local assets to revitalize economies. Sustainable development equals reliable, responsible economic activity that considers tradition, a sense of history, a cyclical view of time, the significance of place, the benefit of personal relationships, and the importance of natural ecosystems (Flint, 2004b). In other words, sustainable development simultaneously considers environment, life, and human well-being by taking a system's approach to understanding and decision-making. And a set of principles can be established and agreed to in order to guide this system's approach. Unlike basic truths about the topic of sustainability (discussed earlier), however, a principle represents a belief that forms the foundation of a fundamental doctrine, like sustainability, or serves as a rule, law, or assumption about the nature of the topic.

As far back as the Brundtland Commission (WCED, 1987), actions intended to promote the idea of sustainability have been guided through the realization of principles able to affect issues that reach across traditional disciplinary boundaries. For example, policies have emphasized leveling global trade activities where markets in wealthier nations are open to poorer countries. Debt reduction for example is used to encourage greater economic equity, and technologies are promoted that enhance resource and energy use efficiency (Gibson, 2002). Other bodies since Brundtland have adopted different perspectives and proposed additional principles to advance sustainability. Biophysical research and ecosystem science have contributed immensely to our understanding of the interdependent functions of nature and how recognition of interconnections is important to preventing unintended consequences from our actions (Jacobs, 2000; Norton, 2005). These efforts have led to the idea of conservation-based development. Similarly notable programs have focused upon helping communities examine their own assets as a means of achieving self-sufficient and sustainable livelihoods through such economic activities as "adding value." And the principle of identifying criteria and indicators of human and ecological well-being has gained wide attention around the world as a way of designing for and adapting to continuing uncertainties (Flint, 2004a).

Principles (described in greater detail below) that can serve as means to assure sustainable decision-making include the following.

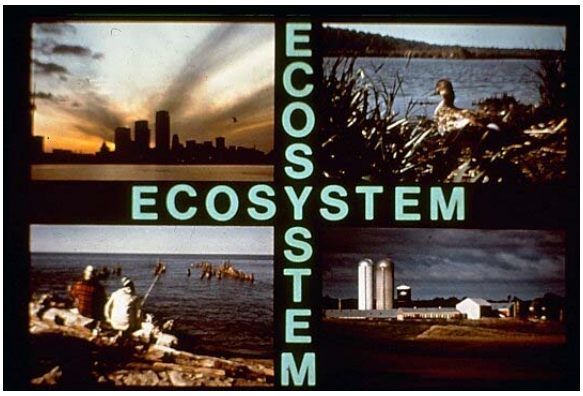
- **Ecological Integrity**
- **Social Equity**
- **Sufficiency and Opportunity**
- **Efficiency**
- **Full Cost Accounting**

- **Citizen Engagement and Democracy**
- **Precautionary**
- **Integrative and Adaptive**

By considering the integrated application of the above principles, plus others that might evolve with further public dialogue, decision-making can encourage protection and equitable distribution of resources to create a sense of fairness, identifying and satisfying real needs before wants and leaving options open for future generations. A number of works over the last 3 decades have illustrated how principles can assist more sustainable action-taking, including the efforts of the IUCN (1980), Robinson, et al. (1990), Straskraba (1994), the International Institute of Sustainable Development (1996) and its Belagio Principles, Choucri (1997), The Hanover Principles of McDonough and Braungart (1998), Gibson (2002), and Robert (2002). These many contributions have provided support and guidance for the following set of **principles** that might be used in guiding design and decision-making with regards to the practice of sustainability. These principles, although possibly not all-inclusive, can offer a practical set of design criteria used to direct economic, social, and environmental decision-making and to transform debate into constructive discussion.

Ecological Integrity – ***Human relationships with the environment must serve to sustain the ecological integrity of natural systems in order to preserve the life-supporting functions upon which socio-economic fitness depends.***

Ecological health is the most important foundation element of sustainability because all economic and social systems are dependent upon good functioning biophysical systems that provide the resources and life-supporting ecosystem services required to maintain healthy societies and drive viable, sound economies. Pursuing the goal of sustainability influences people to promote a sense of stewardship by maintaining and enhancing the environment and its various ecosystems both for their own essential functions, their beauty, their livability as a landscape, and their ability to provide sustainable supplies of natural resources and waste assimilation capacity for all human use, without undermining their function and longevity in the future. In order to preserve the diversity and capacity of nature, its productive area must not be decreased or degraded. We must maintain or enhance the integrity of ecosystems through preventive and adaptive strategies that respond to the threat of global ecological change. We must further recognize the environmental costs of human activities and develop methods to minimize energy and material use per unit of economic activity, reduce noxious emissions, and encourage the decontamination and rehabilitation of degraded ecosystems. The physical scale of human activity must be kept below the total carrying capacity of the biosphere in order to conserve the Earth's vitality and diversity. The scale and throughput of material resources will need to be limited by the capacity of the environment to both supply renewable resources and to assimilate wastes.



The characteristics of human existence interact with and depend upon the natural world, with broad and diverse implications at every scale. We are energetic participants (driving forces) affecting the world's natural, environmental dynamics (Gibson, 2002). These forces are inherent in our human socio-economic systems that are just as complicated, active, and interdependent as ecological systems. Thus, the basic goal of maintaining ecological integrity in light of

human activities requires comprehension of the whole system as well as its interdependent components in order to maintain the biophysical conditions of the life-supporting natural system. A holistic approach to system dynamics considers the well-being (including the state and the direction and rate of change of that state) of human, ecological, and economic sub-systems, their component parts, and the interaction between parts. The system's approach also considers both positive and negative consequences of human activity, in a way that reflects the full costs and benefits for human and ecological systems, in both monetary and non-monetary terms. Synergies and interconnections should be considered in a way that emphasize the inadvisability of addressing bits of the picture in isolation, not accounting for links among social, economic and environmental issues. Informed decision-making to implement actions intended to be sustainable therefore, must take into consideration the concept of an ecosystem approach, where humans view themselves as an integral part of the ecosystem and not independent of ecosystems or nature.

Social Equity – ***Development of programs that are fair must promote greater equity within the community and with people outside the community, as well as between present and future generations (equity over place and time).***

Social equity is the second most important foundation element of sustainable societies, for without equal access to resources, opportunities, and good environments envy and/or conflict will prevail among those who have and those who have not. On both spatial and temporal scales, sustainable communities consider intra-generational equity (*e.g.*, elimination of poverty, viable levels of welfare, protection of public health, and provision of education) and inter-generational equity (*e.g.*, leaving the world in a better condition than we found it and protecting future generations' rights to the opportunities of present generations). Social equity implies that diverse social, cultural, and ecological systems are preserved and that tensions are able to be resolved by distributing costs and benefits equitably (Bryant and Mohai, 1992), creating a sense of fairness. Planning and actions should "ensure that choices of adequacy and effectiveness for all are pursued in ways that reduce dangerous gaps in health, access to clean environments and adequate natural resources, economic security, social recognition, and political influence" (Gibson, 2002). A sustainable society considers equity and disparity within the current population and between current and future generations, dealing with such concerns as over-consumption and poverty, human rights, and access to services as appropriate, the state of ecological conditions on which life depends and the potential for success of economic development and other non-market activities that contribute to human/social well-being. A more sustainable society recognizes and supports people's evolving sense of well-being.

In particular, failure to protect the biophysical environment threatens all people in the future and compromises the ability of many people in less competitive circumstances in the present (WCED, 1987). Bequeathing

ecological wholeness to future generations is the greatest gift we can hope to provide because ensuring the sustainability of our ecological assets is the only way to preserve the opportunities of future generations. The rights of future generations and the notion that the environment is an entity unto itself must be considered in reaching any decision. With regards to people in the present, most basically, as Robert (2002) states "the bounty of the Earth – food, raw materials, natural systems – must be used equitably, fairly and efficiently so that the basic needs of all humans are met locally and globally." Many communities around the world, however, face continuous constraints on their access to materials and economic opportunities, such that their means of making a livelihood and security are in constant peril. Fairness becomes especially important with regards to resources not owned by anybody but rather defined as common property. The communal values of these resources are important to consider in overcoming the potential circumstances described by the "tragedy of the commons" (Hardin, 1968). Inequality can exist among communities in a single nation as well as on a global scale between communities from different nations. This disparity and the associated disproportionate impacts it exerts on different societies has resulted in the degradation of ecological resources as well as the potential for conflict, often growing into circumstances of war and terrorism (Lash, 2001).

All persons should have freedom from extreme want and from vulnerability to economic oppression. Part of this well-being and more effective establishment of equality is related to the degree with which people participate directly and creatively in the decision-making processes and economic activities of the community and/or country. The equality of opportunity should also exist to realize one's full human potential, provide recourse to an open and just legal system, offer freedom from political repression, have access to high quality education and effective access to information, and possess freedom of religion, speech and assembly (Robinson, et al., 1990). We must become efficient and just in our use of resources to assure both an attractive future and the social stability necessary to bring about change that will guarantee that healthy future.

<u>Sufficiency and Opportunity</u> – The idea of "living-off-the-interest" to guarantee a resource will not fall below a threshold required to perpetuate it through time should be a basic premise to insure all people have sufficient resources to achieve a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations (Gibson, 2002).

Global society faces some difficult challenges from the poverty that exists around the world today. Approximately 1.2 billion people – one out of six people worldwide - suffer from polluted water-related diseases, the main reason for illness and death in developing countries. Malaria, both a disease and cause of poverty, kills an African child every 30 seconds. Every day 24,000 people die of malnutrition – half of them are children (Flint and Houser, 2001). The response from many international development entities is to offer short-term economic programs that might alleviate some of the poverty in the developing world. But at what cost environmentally? Too often human improvement is encouraged that correspondingly degrades the ecological integrity of those locales where improvement is being sought. This "leaves the community insecure over the long-term and concurrently has impacts well-beyond the boundaries of targeted improvement" (Gibson, 2002). For

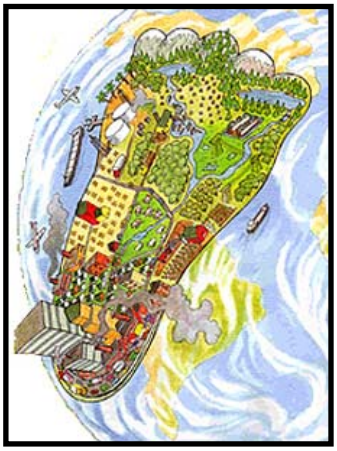
example, consider rainforest regions around the world at risk due to short-term development programs encouraging economic improvement that overtime not only destroy the forest ecosystems but also impact global conditions from loss of biodiversity and large-scale affects on global climate change. As much as 40% of the Amazon's rainforests could be lost by 2050 unless more systemic approaches are developed for assisting poor communities in this region to improve their quality of life (Soares-Filho, et al., 2006).

Today's society should be concerned about making sure that the opportunities they have to achieve their own values, the things important to them, do not in any way constrain opportunities for other places or the future by actions they might take (Norton, 2005). In many instances it comes down to differentiating "needs" from "wants." Decision-making should encourage equitable distribution of resources to create a sense of fairness, identifying and satisfying real needs before wants and leaving options open for future generations. Living sustainably is maintaining the important mix of options and opportunities; living unsustainably is losing them, narrowing the range of options that people in other places or subsequent generations can choose among (Norton, 2005). Applying this principle will promote the idea that all peoples today should have sufficient resources (human, financial, environmental) to meet their needs, provided in a way that does not interfere with the ecological integrity of natural systems, so that similar options will be open to future generations. And these options always depend upon having healthy environments and productive natural resources.

Living off the interest to guarantee that the level of a resource will not fall below a threshold required to perpetuate this resource through all time should be a basic premise of this principle to support decision-making. At present the idea of "living off the interest" is being promoted in agricultural, forestry, and fishery practices where the resource is maintained over extended periods without degrading the soil, or depleting timber stands or fish stocks. "We need to adjust and reconstruct our own human systems to establish more modest, sensitive and flexible relations with the biophysical systems upon which we depend" (Gibson, 2002). Doing better with less is a means of beginning to implement this principle. It involves reducing, reusing, and recycling.

Efficiency – ***Minimize stresses on socio-ecologic systems by maximizing the sustainable use of renewable resources and human capital through reduction in the material and energy use intensity of goods and services.*** "Irrespective of what is possible with current technologies and what is plausible with imagination and creativity, material and energy efficiencies could be increased by a factor of four or even ten, without much strain on existing technological and administrative capacities" (Gibson, 2002). Biomimickry, which is the process of returning to nature as we search for new innovations in many industrial areas and energy use fields, is one way for society to seriously examine means of becoming more efficient. Imaginations can run wild when we think of what the creation of materials from nature's clues could mean. Individuals, companies, product producers, and community builders are now beginning to re-define the economic equation in our society. Waste equals loss of energy, similar to the way that nothing is wasted by nature, is the formula that is beginning to close the loops in our thinking (biomimickry), and in doing so re-defining the way we live. We are however, early on the learning curve of mimicking the patterns of nature in our human culture. For example, ours is the

first generation to gain awareness that every community within the larger global community has an ecological footprint. Understanding the nature and limits of that footprint is to live in a sustainable manner.



Within the context of biomimickry, the idea of Industrial Ecology is now being seriously considered by many businesses as a holistic and integrative approach to the traditional take-make-waste practices. This idea uses the metaphor of metabolism to analyze production and consumption by industry, government, organizations and consumers, and the interactions between them (Flint, 2004b). It involves tracking energy and material flows through industrial systems (*e.g.*, a plant, region, or national or global economy) with a view for more efficient operations; from the standpoint that instead of cradle to grave views, companies are now considering cradle to cradle perspectives, where waste from one process is food for another. We can eliminate the concept of waste by evaluating and optimizing the full life-cycle analysis (LCA) of products and processes, to approach the state of natural systems in which there is no waste. Considering the entire life cycle of a product, process, or resource use during design activities mimics the cycle of use and reuse of all materials found in the natural world. Additionally, from the LCA perspective, designers of industrial process, product manufacturing, and even community building, gain inherent opportunities for improving design. Materials tend to be selected more prudently and used more efficiently. And consideration of alternative materials or sources of energy are built into the design process.

In considering means to be more efficient and provide opportunities for the saving of resources there is a central problem to be overcome – that efficiency gains are of no great value without changes to ensure the savings do not merely go to more consumption (Patterson, 2000). Gibson (2002) cautions that if reductions in energy use for example facilitate more energy consumption elsewhere, there is no net gain. "If the savings go into more consumption by the already affluent, prospects for sustainability are likely to decline." Efficiency gains will only be realized in overall material and energy use by well-informed activities that promote the de-coupling of well-being and consumption – implying that human well-being can be achieved at the same time as reductions in material and energy consumption. Therefore, initiatives to reduce material and energy throughput will be beneficial only if designed and implemented in comprehensive approaches that seek overall gains and consider the resulting distribution of benefits in cumulative, holistic approaches, understanding that transference of a problem from one place or media to another is not sustainable (Gibson, 2002).

<u>Full Cost Accounting</u> – ***Move beyond the traditional economic application of market costs by incorporating net environmental gain as an objective of decision-making to guarantee environmental and social benefits.***

Poorly-conceived discussions of sustainability often attempt to balance conservation and development activities, which suggests sacrifices, perhaps for both human and ecological imperatives. For example, a strategy might involve some further loss of ecosystem integrity "balanced" by some restriction in immediate extractive gain (Gibson, 2002). But this approach is deceptive because in the absence of "full-cost accounting" decision-making to ensure that unavoidable or inevitable projects at a minimum guarantee environmental and social benefits is flawed, not representing the true value of environmental goods and services. The result is net ecological loss.

Our natural assets – air, water, land, soil, forest, wilderness, fishes, and wildlife – are the underlying base of all our economic activity and are required to support a growing human population. Market costs rarely reflect the inclusion of environmental or social cost components, such as resource replacement costs or the potential costs associated with clean-up or environmental damage (Daly, 1996). Net environmental gain, as represented by the concept of full-cost accounting, should be an objective of decision-making to insure that unavoidable or inevitable projects at a minimum guarantee environmental and social benefits. Improved valuation, pricing, and incentive mechanisms should become second nature in decision-making in order to make the environment a forethought and not an afterthought. One mechanism for advancing this principle is to identify economic incentives that will influence more wise resource use. The challenge is to define and implant the principle in a way that minimizes adverse effects on individuals and groups, or on our international competitiveness. Prices for natural resources should be set to recover the full social and environmental costs of their use and extraction. Many environmental values cannot be priced in monetary terms and hence pricing policies will form part of a broader framework of decision-making;

Paul Hawken (1993) said that the most damaging aspect of the present economic system is that the expense of destroying the Earth is largely absent from the prices set in the marketplace. The damage to the environment after it has been stripped, cut, burned, or spilled upon is not counted in the Gross Domestic Product (GDP). While we focus on earning our living, we tend to ignore what we have been given by nature for no payment. Air, water, and other essentials of life provided freely by nature are treated as valueless, that is, until scarcity and privatization render them marketable (Korton, 1995). A perfect example is when the Exxon Valdez oil tanker ran aground in Prince William Sound, Alaska in 1990s (Flint and Houser, 2001). The millions of gallons of spilled oil killed millions of animals and cost millions of dollars to clean up. The jobs created and materials manufactured related to clean-up activities of the polluted water and beaches, as well as the aid provided to impacted communities, made the U.S. GDP go up. In contrast, the lost natural resources did not cost anything according to our national methods of accounting. Therefore, the fact that communities made money from clean-up costs, with no accounting loss related to natural resource damage, suggests that we should get more oil tankers to run into rocks more often. As preposterous as it may sound, most nations, including the U.S., presently don't value natural resources not traded in the market place. If full-cost accounting practices were in effect, the Exxon Valdez oil spill would be viewed in terms of a cost, not as a benefit as reflected by the GDP.

<u>Citizen</u> <u>Engagement</u> <u>and Democracy</u> – ***Develop processes such as informed decision-making that improve society's capacity to understand and apply sustainability principles through enhanced citizen engagement, transparency, and the taking of responsibility.***

Sustainability is not entirely, and perhaps not even chiefly, a matter of government and administration as usually conceived. Any set of sustainability principles such as those described here, is going to require the consideration of a range of socio-economic and environmental interactions that can only be addressed by significant behavioral and attitudinal changes. The majority of problems affecting sustainability will not be solved through the mandating of regulations or legislation, but rather are most often impacted by activities at the grassroots level of society where stakeholders become better informed, change their behaviors and attitudes, and find things in common to agree upon.

Capacity building activities should be consider that develop a "sense of community" among members and strengthen the key features that make communities viable and effective. The dissemination of information and opportunity to listen to citizen ideas can be accomplished through public engagement.

The success of civil society function is achieved by the degree of stakeholder engagement that occurs to support democratic processes (Flint, 2004b). In most instances, to achieve long-term change a civic critical mass of community participation is required. Engagement is a participatory approach to managing a region that blends concepts of good governance, consensus building, the assuming of civic responsibilities, and strategic planning. A more sustainable community enables people to feel empowered and to take responsibility based on a shared vision, equal opportunity, ability to access expertise and knowledge for their own needs, and a capacity to affect positively the outcome of decisions which influence them.

The status and quality of institutions in a community are key to encouraging the participation of all affected people in decision-making and promoting the civic values of trust and cooperation. Businesses, neighborhood and community groups, the media, and citizens, as well as governments and NGOs, influence governance through effective participation. Proponents of strong communities seek to make citizens' voices heard in governance and to achieve greater transparency in government decision-making and programs. In sustainable communities institutions function effectively to satisfy the physical needs of their citizens while preserving the environment by providing citizens with the information and opportunities necessary to participate meaningfully, through an open, transparent, inclusive, and accountable decision-making process. Sustainable communities elicit support from businesses, local government, and citizen organizations and work with other communities in a larger context, in a spirit of connectivity. In lieu of reaching full consensus, the community can then make reasoned and balanced decisions, informed by the community's core values.

<u>Communication and Cooperation</u> – ***Society needs systems of accounting and means of communicating to encourage cooperation.***

When we enact new programs, how do we know that they are successful? We must identify metrics for measuring

whether things are getting better or worse. In efforts to assume responsibility for preserving and/or enhancing things to support the needs of other people and future generations we must possess criteria and indicators to tell us we are achieving sustainability (Farrell and Hart, 1998; Hart, 1999). And we must be able to talk about the state of presumed sustainable activities through a common language for communicating both expert and public-ways-of-knowing. Policy-makers and leaders can directly enhance the public confidence by sincere communication. And communication leads to social learning. Cooperation among people with varying views is only possible if they possess means of discussing their differences and understanding each other's views (Norton, 2005). And with cooperation comes communication, which allows consideration of multiple values. Commitment to cooperative action will encourage the tasks of developing, explaining, and implementing procedures that will support deliberation with an ideal-as-possible speech community (Bernard and Young, 1997).

Precautionary – ***Respect scientific uncertainty by making decisions that anticipate and prevent, which is preferable to reaction and cure, in an effort to avoid poorly understood risks of serious or irreversible damage to the environment, and plan for surprise (Gibson, 2002) to remain consistent with inter-generational equity.***

The response of the past – "react and cure" – has proven to be economically, socially, and environmental expensive. As we come to better understand the concept of sustainability it becomes apparent that we should instead adopt a philosophy which "anticipates and prevents" environmental degradation at the planning stages of development projects and when we make consumption decisions (Maser, 1997). The complexity of biophysical and socio-economic systems, however, limits our information and ability to gauge for changes, either positive or negative, causing a certain degree of uncertainty with regards to scientific understanding. And uncertainty is not just ecological, but also surrounds the potential impacts of forces such as globalization and decentralization, effects of movements of global markets and trade regimes, and the effectiveness and utility of conservation measures such as protected areas, use of incentives, or strict regulatory approaches.

The uncertainty surrounding potential threats to the environment for example, has frequently been used as a reason to avoid taking action to protect the environment. Such uncertainty underpins the arguments both of those exploiting resources, who demand evidence that exploitation causes harm before accepting limitations, and those who seek to limit exploitation in the absence of clear indications of sustainability. Many people often see the same issue from varying perspectives making agreement on possible actions difficult and chancy. But it is not always possible to have clear evidence of a threat to the environment before the damage occurs. It is complicated to predict what preventative actions might be appropriate. This uncertainty suggests the need for considering the idea of precaution in the actions we take, rather than the desire to "minimize" damage which we may not be able to define. Thus, acknowledgement for uncertainty is inevitably part of the sustainability discussion.

Precaution – the "precautionary principle" or "precautionary approach" – is a response to uncertainty, in the face of risks to health or the environment. "Precaution involves the willingness to act on

incomplete but suggestive information where social and ecological systems that are crucial for sustainability are at risk" (Gibson, 2002). An element common to the various formulations of the Precautionary Principle is the recognition that lack of certainty regarding the threat of harm should not be used as an excuse for not taking action to avert that threat. In general, it involves acting to avoid serious or irreversible potential harm, despite lack of scientific certainty as to the likelihood, magnitude, or causation of that harm. This anticipatory and preventative policy approach should err on the side of caution, placing the burden of proof on technological and industrial developments to demonstrate that they are ecologically sustainable. The Precautionary Principle recognizes that delaying action until there is compelling evidence of harm will often mean that it is then too costly or impossible to avert the threat. Use of the principle promotes action to avert risks of serious or irreversible harm to for example the environment. The principle therefore provides an important policy basis to anticipate, prevent and mitigate threats to environmental or social systems. Precaution is now an established principle of environmental governance, prominent in law, policy and management instruments at international, regional and domestic level, across such diverse areas as pollution, toxic chemicals, food and sanitary standards, fisheries management, species introductions, and wildlife trade.

Integrative and Adaptive – ***Decision-making processes for developing, testing, and refining a common framework for learning from experience wherever promising approaches to problem-solving are undertaken should effectively integrate both long-term and short-term economic, environmental, social, and equity considerations.***

Assessment of progress toward sustainability should encourage development of a capacity for repeated measurement to determine trends, be iterative, adaptive, and responsive to change and uncertainty. It should be able to adjust goals, frameworks, and indicators as new insights are gained, promote development of collective learning and feedback to decision-making, and never be considered absolute (fully definitive) because systems are complex and changing (Gibson, 2002).

Assessment of progress toward sustainability should also adopt a time horizon long enough to capture both human and ecosystem time scales, thus responding to current short-term decision-making needs as well as those of future generations. Evaluation approaches should define the space of concern large enough to include not only local but also long distant impacts on people and ecosystems. And the procedure should be built upon historic and current conditions to anticipate future conditions – where do we want to go, where could we go.

To lessen concerns for acting out of precaution, without always possessing full information, the idea of adaptive management has been advanced. Adaptive management is a decision-making processes that effectively integrates both short-term and long-term economic, environmental, and social concerns. It provides a mechanism to evaluate and fully consider all the other principles discussed above. It also provides an excellent opportunity for the integration of both the expert-way-of-knowing and the citizen-way-of-knowing, often referred to as citizen science (Flint, 2004a). This strategy is built upon the premise that people learn from their actions, as well as their mistakes. An adaptive, learning-based approach to the practice of sustainability implies the constant attention to and

evaluation (monitoring) of activities to ensure one's continuous awareness and understanding of changes in circumstances, looking for ways to maintain flexibility by identifying feedback loops, making sure they give timely and relevant information, and then paying attention to them, being prepared to abandon unsuccessful strategies (Ruitenbeck and Cartier, 2001). Adaptive management includes both the use of science in management and a collaborative process in which participation and social learning are an important part. The idea of adaptive management will be discussed more fully in the following section "Transitioning to Sustainability."

The integrated application of the sustainability principles discussed above and simultaneous reconciliation of sustainability objectives, as implied by the analogy of the 3-legged stool concept discussed earlier (if actions to address all three sectors are not synchronized, the stool will fall over), are both key to substantial overall progress towards sustainability in the long-run (Flint and Houser, 2001). The above principles offer some guidance on how to begin the journey to more sustainable lifestyles.

Transitioning to Sustainability (alternate to the "all or nothing" approach)

Traditional environmental management emphasizes a process of continual environmental improvement where the ultimate destination is typically left undefined. How likely are you to achieve a major goal without being clear about what you are trying to accomplish? In contrast, sustainability challenges society to set specific goals and then continuously align its strategy and operations toward that end. But societal desires to achieve sustainability goals often require significant changes in behavior and use of resources, causing huge challenges that can deflate original good intentions.

In the middle of all the concern and hypothesizing about taking actions that will promote environmental, social, and economic sustainability therefore, another term needs to be included, recognized, and applied where appropriate. That term is **transitional** – the process of moving from one state of being to another or one material, resource or practice to a different, less negatively impacting an alternative material, resource or practice. Although not a substitute for the real thing (*i.e.*, sustainable), transitional suggests a lesser barrier to changing our ways. If we feel bad about our circumstances and yet have no clear idea what is best to do next, thinking of transitional options is useful and may be easier to adopt.

Something is transitional when it is seen as a better way to go than what is happening currently, yet it is a temporary measure only. The idea is to take a step in the direction of sustainability rather than cutting straight to the purely sustainable alternative, which is often a huge jump. The smaller step is more supportive of change for the better and is not as steep a learning curve. There need not be any interruption in consumption or enjoyment of a product or activity except that the variety or version of that product is more desirable from a sustainability point of view – *e.g.*, organic, permaculture vegetables in place of normal,

monoculture vegetables. In both cases, vegetables are grown, sold, and consumed. In the case of organic or permaculture vegetables, however, no chemicals are employed, nor does soil degradation or over-consumption of water take place, so they are more environmentally friendly.

Sustainability refers to that which is renewable and non-impacting, so transitional materials or practices are, by comparison, less polluting, readily available with low or at least lower impact. Perhaps transition is the state we are in all the time, because life is constantly changing so this is not a new concept. What is different and more valuable about transitional change is the nature of the change – towards lower or non-impact, renewable, strategies that empower the individual. So, as an alternative, when we see a way to make any change from a transitional perspective, it can be much easier, lessens the guilt, and brings a greater self confidence and self reliance sooner. Ideally, this is the path many are better off taking; it offers hope and still can lead to sustainability. An example of this is switching to natural gas for heating because we have seen the disadvantages of using coal. Both are finite sources of fuel for generating energy yet natural gas is less polluting and may also be seen as a step in the right direction, away from coal dependency. Neither source, however, is sustainable.

Part of normal transition or change leads directly to sustainability, though not all, so there is a need to distinguish between what is "transitional" and what is not, and what actually is sustainable. All life on the planet up until now is in a temporary condition or a transitional phase with death and decay part of life. Undisturbed it is intrinsically renewable hence sustainable. But interjection of the human factor has eventually affected this sustainability. Beyond that, because we are now aware of damage to the environment and its sensitivity, such as global warming, some change purposely promotes sustainability only. And it must be clear: a theory of change informs strategy, but it is not *the strategy*. A theory of change is how one thinks the social change being sought can occur, and what needs to be in place to make it happen. Typically a theory of change is based on a combination of objective evidence drawn from research or experience, and subjective opinion and personal ideology. Decisions on what aspects of the theory deserve attention help lead to choices about positioning and an eventual articulation of the strategy. A theory of change can help us think about sustainability because it forces the very real consideration of the time and resources needed to achieve meaningful change or to make a demonstrable difference that is going to last beyond the life of the initiative.

To assist in identifying specific goals and defining action strategies, including describing transitional steps toward sustainability, sustainability practitioners are beginning to rely upon the participatory, transparent, and all-inclusive advantages offered by the application of citizen science and adaptive management strategies.

Citizen Science: In our contemporary world broad historical trends, political and community structures, and the texture of daily life are all shaped by research, science, and technology in more profound and subtle ways than most people realize. The effects of science and technology extend from relatively obvious environmental repercussions, such as pollution, to critical social and political consequences, such as job insecurity, community atrophy, and ultimately a dysfunctional democracy. Science has solutions to offer on urgent issues such as energy, fresh water, food production, and health, but

new approaches are needed to more effectively influence policy-making. In order to help anticipate and avert the impacts of unintended outcomes, it is essential to interject community perspectives into science and technology decisions. There are practical ways to enable people from all walks of life to contribute to science and technology choices, thereby improving people's well-being and the well-being of their communities. But this requires emphasizing the ways of doing science as much as the means. The increasing importance of science in today's world calls for far greater interaction among all stakeholders and for a truly global perspective in research.

On the one hand, science is about objectivity, reliability, and validity (non-normative): what will, or might, happen. Societal decision-making however, is human value-based and supported by community advocacy (normative): what should happen (Norton, 2005). This realization causes us to begin thinking about a new direction in community-based decision-making and governance that can most effectively benefit from the use of science by:

- identifying the communities/constituencies;
- evaluating their attitudes, perceptions and values;
- engaging them in a facilitated/consensus-building process;
- assessing common goals and commonly-developed alternatives; and
- promoting effective advocacy.

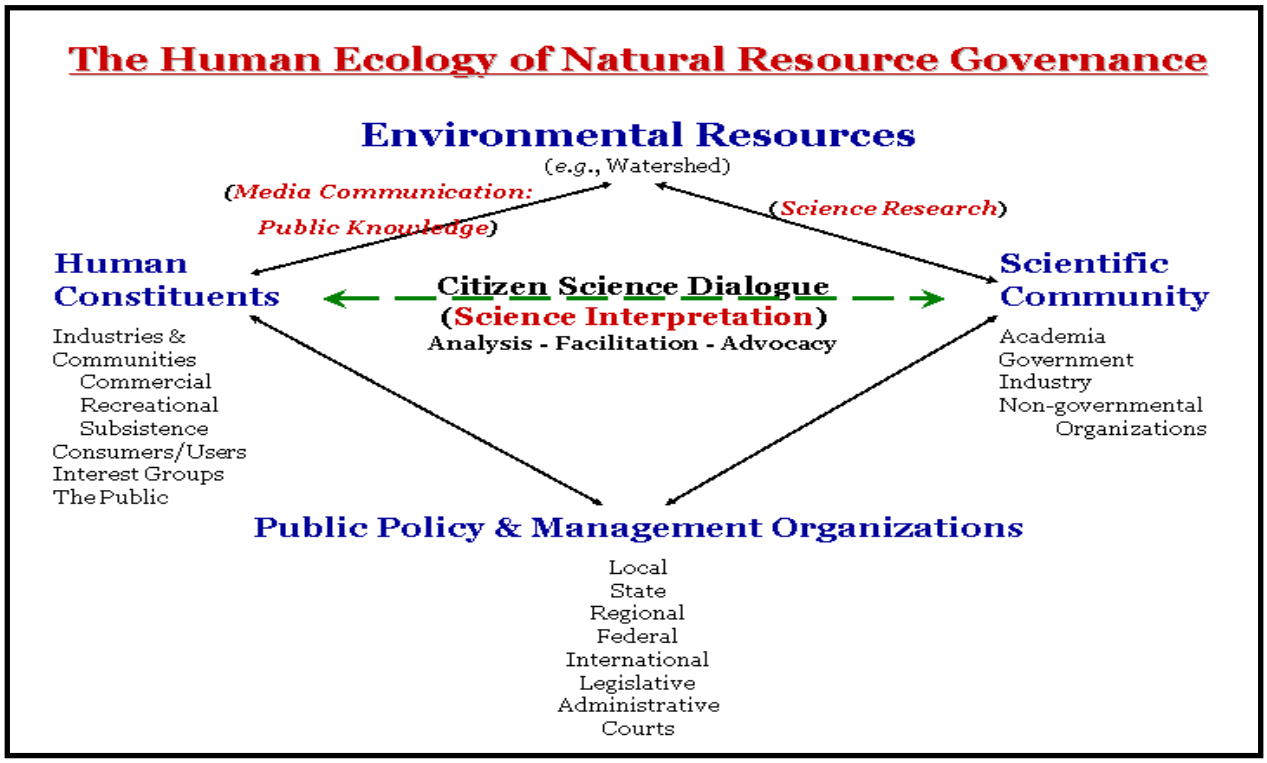
Community-based research, within the context of citizen science, differs fundamentally from mainstream research in being coupled relatively tightly with community groups that are eager to know the research results and to use them in practical efforts to achieve constructive social change. Community-based research is not only usable, it is generally used and, more than that, used to good effect. Community-based research also often produces unanticipated and far-reaching ancillary results, including new social relationships and trust, as well as heightened social efficacy (Lubchenco, 1998). It may thus provide one constructive response to the growing concern that American civil society is in crisis and unraveling.

Promoting community-based research, by making empowerment through mutual learning universally accessible, can better direct our extraordinary capabilities toward our most urgent social and environmental needs. We can help alleviate suffering, revitalize democracy and community life, and bequeath future generations a world better than we found it. But a new social contract of science will be needed that encourages greater interaction in the conduct of citizen science (Lubchenco, 1998): the public-way-of-knowing coupled with the expert-way-of-knowing. This greater interaction requires improved communication of science to the public and higher levels of scientific literacy in order for people to influence how science and technology affect their lives.

Ecologists, sociologists, and economists will have much more impact on policy if they use terms that transparently link technical information and theory to widely favored civil society values and goals, through the use of citizen science techniques. Failure to employ language that helps stakeholders from civil society make connections between science and technology trends and social values has a great cost (Norton, 2005): the public and the policymakers know whether trends in data are good or bad only if they are willing to learn a significant body of scientific information and its application to sectors of public interest. Experts, mostly unwittingly, have created a conceptual gulf between the information they gather and the social values people cherish, making it very difficult for participants in policy discussions to see the relationship between ecological and socio-economic science and public

values. Policy discourse currently suffers because, whereas economic data is easily associated with the well-being of citizens in our democracy, ecological data has no such resonance. And yet, in the overall dialogue about community values the two are very much interrelated.

Science has to meet the real needs of real people, respecting individual rights and empowering communities, to win public and political support (Bernard and Young, 1997). A model demonstrating how this can happen is shown in the adjacent diagram. The model illustrates the central, cross-cutting role for science so that capacity-building and the transfer of knowledge enable communities to address, for example their conservation-based development needs. By building models for doing science in a more interactive and inclusive way, we can make active partners of all the parties involved and ensure the full participation of all potential stakeholders.



When one shifts from a view of science as exclusively an academic activity and begins to see science as a part of a larger social dialogue and deliberation – if one begins, that is, to see science as mission-oriented instead of exclusively curiosity-driven – relevance to real social values becomes one important determinant of what counts as good science. Sustainability practitioners should believe in sharing scientific and technology information as a part of the public process, rather than as an input into the process from the "outside." This is demonstrated by the above diagram that shows experts sharing information with civil society to develop "public ways of knowing." Successful use of science in a public, democratic policy formation process requires a free flow of information in multiple directions. What the idea of sustainability is missing up to now, is a multidisciplinary, integrative language capable of supporting multidisciplinary public discourse and deliberations.

As Leshner (2005) recently stated, "the nexus where science meets society," reminds us of many events of the past few years that suggest the relationship between science and society is undergoing

significant stress. Science and its products are intersecting more frequently with certain human beliefs and values. Some members of the public are finding certain lines of scientific research and their outcomes disquieting, while others challenge the kind of science taught in schools. This disaffection and shift in attitudes predict a more difficult and intrusive relationship between science and society in times to come if we don't find another way of "doing business."

As science encroaches more closely on heavily value-laden issues, members of the public are claiming a stronger role in both the regulation of science and the shaping of the research agenda. Therefore, we should and can adopt a much more inclusive approach that engages many different sectors (communities) assertively in discussing the meaning and usefulness of science (Lubchenco, 1998). We must try to find common ground through open, rational discourse. And if the business sector takes note of the potential benefits of a new relationship between science and society, then public and private interests would converge, generating a force for progress powerful enough to meet the challenges of today and tomorrow.

A theory of effective community capacity building with regards to economic and environmental management must be a theory of action. The actions can be motivated only by social values, and all actions, including scientific study, are suffused with values (Norton, 2005). No system for managing the environment or a community's economy can be understood in purely physical terms. Understanding the physical systems involved is of course important. But since we seek a system of active management, our scientific models must be understood as embedded in a larger process of social discourse and political institutions. Our processes of management must therefore include a means of identifying, justifying, and/or legitimating science by reference to some social value. This is exactly where the application of citizen science can make a real difference.

Adaptive Management: Society needs a framework for tracking and understanding changes to the health of resources. Citizens and other stakeholders in communities are increasingly demanding to be well informed about the activities of government as well as economic development interests, to have emphasis placed on socio-economic and environmental sustainability of their communities, and to have significant input into the decision-making processes of government and industry that directly affects this sustainability. From these growing needs of civil society to have the capacity and be empowered to take charge of their own destiny, it becomes apparent that a new methodology is required to understand the implications of long-term changes for ecosystems, communities, and businesses that will adequately involve all interested stakeholders in dialogue and decision-making pertinent to their futures. The most successful methods will also possess the additional property of reversibility; only actual experience can tell us if we are on the right track – if not we must be able to make changes.

Promoting citizen science processes is a way of assisting civil society to have the capacity and be empowered to take charge of their own destiny. A management framework is required, however, that can support the conduct of citizen science and engagement of all interested stakeholders in dialogue that is holistic and all-inclusive, processes that emphasize learning from action, and decision-making pertinent to their futures. An effective means to accomplish this goal of full public involvement, awareness, and integrated discourse is through the application of an adaptive management strategy.

Adaptive management is a search for community practices that maintain the options important to a culture living in a place – a process by which new information about the health of a particular system is incorporated into a management plan. Adaptive managers come to recognize that survival – a thriving human culture – is a matter of community adaptation, community foresight, and social learning, all of which evoke values that transcend individual, consumptive goods of economics and point toward a responsibility to a larger and ongoing culture. The word "adaptive" and its meaning are important in developing sound resource management plans. Adaptive management is a challenging blend of scientific research, monitoring, and practical management that allows for experimentation and provides the opportunity to “learn by doing.”

An adaptive, learning-based approach to decision-making implies developing, testing, and refining a common framework for learning from experience wherever promising approaches to problem-solving are undertaken. Adaptive management includes both the use of science in management and a collaborative process in which stakeholder participation and social learning are an important part. Adaptive management also suggests the constant attention to and evaluation (monitoring) of activities to ensure one's continuous awareness and understanding of changes in circumstances, in order to feed-back information to decision-making endeavors. It is a necessary and useful tool because of the uncertainty about how ecosystems function and how management affects these natural systems. Such an adaptive approach refers to:

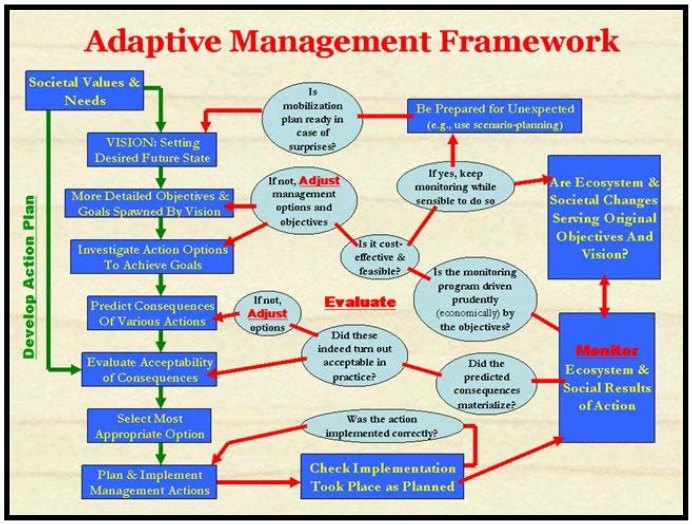
- improving decision-making;
- enhancing linkages among different disciplines, including science and policy; and
- maximizing lessons learned from different experiences.

So, adaptive management represents a philosophy of management assisted by the application of citizen science. The same philosophy that governs the search for scientific understanding also governs the search for better management solutions and guides revisions of values and evaluations when observation and experience indicate the need for such revisions. Adaptive management is as much a search for the right thing to do as it is a search for the truth.

As illustrated in the diagram below, the adaptive management procedure includes the following components:

- To develop a plan for managing a system or resource.
- To create processes to monitor changes in the system or resource as affected by the management plan.
- To evaluate system trends using the monitoring data.

- To modify the system or resource management plan as necessary, indicated by the evaluation process.



Adaptive management offers significant hope for moving beyond the quagmire of traditional decision-making because rather than imagining that the policy formation process is carried out in two realms – the realm of science and the messier realm of policy, goals, and values – citizen science dialogue as illustrated in the previous section will bring the realms of science and social values together in a process of adaptive management, having two related phases. The adaptive management focus is community sustainability with regards to environmental and socio-economic policy; and it includes the two alternating phases, an action phase and a reflective phase (Norton 2005). In the action phase the focus is on what ought to be done, which includes asking what we do know and what we need to know if we are to achieve stated goals according to specified criteria and measurements. It is assumed that multiple participants will advance a variety of overlapping and some opposing goals. Taking action might include consideration of very general rules, such as the cost-benefit test, the safe minimum standard of conservation rule (which tells us to protect a productive resource "if the social costs are bearable"), and the precautionary principle (Norton, 2005). The action rules might also include much more specific, locally applicable criteria designed to track particular important features of local places. Here descriptive science is used to determine what is possible and what means are likely to achieve the stated goals.

Action phase criteria, however, cannot be applied in every situation, nor should they be applied willy-nilly and at random. Therefore the search for rational and democratically acceptable environmental and economic policies also requires a reflective phase. This phase involves the community discussing which variables to monitor in a particular situation – the sorts of measures and indicators we will use to keep score of how we are doing in the game of sustainable living (Norton, 2005) – and which goals and values to pursue, based upon feedback from actions taken so far. And the public must in some way contribute to the choice of these goals of management.

Often an ecosystem-scale change as a response to societal impact occurs more rapidly or is larger than expected because communities in general are non-linearly interacting systems of one or more components, with abundant feedbacks. Most of these changes are surprises, so scientists and managers must be flexible (adaptive) to accommodate these surprises. Surprises become well incorporated into scientific understanding when they form the basis for further predictions that are confirmed through an adaptive approach. The understanding from these unintended experiments and their surprising outcomes, as gained in the reflective phase ("evaluation" in the diagram above) will lead to "adjustments" in

management practices. This is especially meaningful to environmental managers because it provides the ability to formulate and implement policy as well as to more easily understand ecological systems. The hallmark of this ecological understanding is an ability to predict. Examples from meteorology provide useful correlates. "Weather-forecasting" introduces the notion of iteration between models and observations, comparing the forecast with actual observations and updating the model forecast based on these observations.

Citizen science applications can assist an open public process in developing adaptive management strategies. Experts can contribute to this procedure by helping the community to understand key environmental and economic processes and to identify measurable variables that may be important. Interest groups can play a role, because they will want to insist that the indicators chosen reflect the values they support and that the standards chosen are appropriate from their perspective. In the process of disagreement, managers can identify important areas of uncertainty and differences and propose “safe-fail” experiments to reduce this crucial discord (Norton, 2005). A provisional decision can be made, to proceed with particular, proposed indicators and to apply a proposed set of standards. The reflective phase is then replaced by the action phase, wherein the community again chooses particular actions and policies and sets out to judge these according to appropriate criteria – that were sanctioned in a previous reflective phase.

Adaptive managers do not claim to know in advance what policies are sustainable or even what the goals of sustainable living are, but rather accept uncertainty and surprise as an unavoidable element of goal-setting and management decisions. Thus, they propose an open-ended, experimental approach to the management of community capacity building in the present circumstance of pervasive uncertainty. In this approach goals and policies must be approximately set and adjusted as new information comes in from management experiments. Adaptive management is here understood as being undertaken within a democratic society, in which interested citizens, either as representatives of their interest group or simply as individuals, participate in this open-ended, experimental process of management. It is hoped that this strategy will result in social learning, in the emergence of shared goals and policies, and in greater environmental protection and economic security. The possibility of social learning is therefore the central driving force of adaptive management; and this driving force should sharply focus our attention on the deliberative and political processes associated with an adaptive management partnership. Adaptive management is thus a strategy that can both reduce uncertainty regarding particular matters of fact affecting management decisions and reduce disagreement about goals, objectives, and values.

In this management process the community formulates the overall problem – the problem to which a unified definition of sustainability will hopefully provide a solution – as one of choosing more than one criterion to form a multi-criteria system of evaluation. This multi-criteria system of evaluation can be applied to proposed development paths, considered as possible paths from where a community now is to where it might be in the future if particular choices are made and particular policies are chosen.

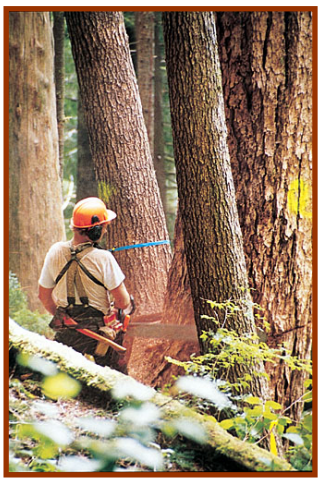
Living sustainably is maintaining the mix of important options; living unsustainably is losing them, narrowing the range of options that subsequent generations can choose among in their attempt to adapt,

survive, and prosper (Norton, 2005). To make this schematic definition a real definition, we must endow communities with the ability to choose what is important to protect and what is important to monitor. Adaptive management describes a strategy that starts where we are and struggles toward better policies through social learning. Adaptive management, if supplemented with a good beginning of options and opportunities (graphic understanding for sustainability), provides a very simple model for conceiving the difference between sustainable and unsustainable communities.

A Practitioner's Challenge in Sustainable Development

Sustainability approaches to decision-making are consistently becoming a more widely accepted objective. Sustainable development implies the ability of humans to harmoniously coexist in a manner that maintains wildlife, wildlands, decent environments, social equality, and economic well-being today and for future generations. Sustainability evaluations, as a preventative approach to environmentally and socially regrettable undertakings, is seen as a means of expanding the emphasis of considerations in decision-making that provides a more comprehensive assessment of the many multi-dimensional problems society faces today. But, the central principles of sustainability are not always well elaborated or applied – there is significant room for improvement on how sustainable development should be translated into practice. This is in part because we are just beginning and in part because seeking sustainability means challenging conventional assumptions and practices.

To achieve sustainability we must revamp the process of decision-making and the carrying out of activities by professionals, supported by our understanding of science, that will: (a) integrate actions of conservation and human economic development; (b) satisfy basic human needs; (c) achieve equality among people and social justice for all; (d) provide social self-determination and cultural diversity; and (e) maintain ecological integrity. The time has come for professionals to learn about and implement a multi-dimensional way of thinking about a future for our children in which environmental, societal, and economic concerns are considered equally, and at the same time, in the pursuit of an improved quality of life for everyone. If we don't the result is inequality in access to resources and quality of life, which equals conflict. The challenge for practitioners is to begin to conceptualize sustainability in the context of inter-disciplinary scientific understanding and promote the taking of action that reaches across boundaries, disciplines, and cultures.



Scientists and policy-makers have begun to recognize it would eventually be suicidal to allow a further undermining of the sustainability of ecological life support systems, locally and globally. At the same time, they acknowledge that development is required to eliminate destitution, ensure material security, and allow individuals and communities more choices and more power to exert greater control over the factors affecting their lives – thus the call for "sustainable development." But the practice of sustainable development by professionals can be comparable to a slippery piece of soap

with regards to consistency and standardization. At the same time, a combination of socio-economic and environmental forces related to present global conditions have led to accelerating interest in mechanisms for promoting and verifying/validating the quality of professionals practicing sustainable development around the world. The concept and recognized need for sustainable development in a global arena has matured to the point that society expects practicing sustainability professionals to act as responsibly in advancing socio-economic progress, protecting human health, and conserving natural resources as other licensed professionals (such as architects, engineers, surveyors and medical doctors) do in their respective fields. Professional credentialing bodies — setting and administering standards for scientists, sociologists, economists, planners, and other professionals advising on inter-disciplinary sustainability practices — are being called upon to fulfill this universal need.

As more of society becomes focused on sustainability and its philosophical foundation, new dimensions are called for in professional preparation of the sustainability practitioner. Consider the great shifts over recent years in public attitudes about diet, exercise, fitness, preventive health, and wellness; or about pollution, global warming, and atmospheric ozone depletion. Such agendas have begun to sink in. Tough issues remain, however, that are going to require a new way of preparing the sustainability professional to deal with complex, interconnected issues not considered in traditional approaches. The goal is for the professional to realize and commit to the need for continual examination of linkages among economic, social, and environmental issues in achieving a sustainable, global society through the use of science and technology. Practitioners should also be able, however, to realize that issues involve moral choices as well, and that information from several disciplines enables them to make more informed decisions. In general, emphasis needs to be placed on how the sustainability practitioner can implement a new social contract for science that encourages greater interaction in the conduct of citizen science (the public way of knowing coupled with the expert way of knowing), adopting a much more inclusive approach that engages many different sectors assertively in discussing the meaning and usefulness of science to advance sustainable societies.

Because of the many different skills required of any professional today, consideration needs to be given to a new model for continued professional development of the practitioner that emphasizes a sustainability-oriented program of training. Professionals must experience a reorientation to existing education that includes: (a) principles, skills, and perspectives related to sustainability; (b) learning that is appropriate and relevant; (c) a vision that integrates environment, society, and economy into a “big picture;” and (d) knowledge of tools and methodologies to employ in guiding and motivating people to participate in a democratic society, assess their core values, and live in a sustainable manner. With the appropriate training and continued professional development approaches, the sustainability practitioner should be able to bridge the gap in aligning economic practices with social and environmental goals as well as assist decision-makers to both select and synergize their efforts for maximum strategic effectiveness and efficiency.

Unlike conventional training which assumes specialization in one area and then the automatic coming together of different disciplines (*i.e.*, individuals) to apply common knowledge, a new approach must prepare the sustainability practitioner in multiple discipline thinking and application to affect more sound problem-solving based upon an individual's ability to communicate multiple and related issues.

Cross-disciplinary training enlarges the professional's awareness of issues and methods beyond their own disciplinary enquiry, enabling them to explore the interrelations of these issues and methods, and encouraging professionals to regard their own practice in a broader social and ecological perspective. Likewise the integrative approach will produce a new generation of practitioners that are both sensitive to the intrinsic value and inherent worth of the natural environment, as well as responsive to the fact that science and technology should be used for nature's sake and not simply as a means to exploit nature for human's continued use. Obviously, individuals cannot have all the specialized knowledge relevant to a decision in their private, work, or civic life. They must realize through the training process, however, that such information is relevant and available.

The advancement of long-term environmental, social, and economic quality of life experiences can be approached on at least three levels (individual, organizational, and societal) by practitioners. Likewise, sustainability can be thought of as integrated sets of system elements, such as inputs, processes, outputs, and feedbacks. A new paradigm for a multi-level, multi-system's perspective of sustainability is required, allowing practitioners to both select and synergize their efforts for maximum strategic effectiveness and efficiency. Sustainability can be measured at each of these levels, and each of the systems aspects can, in turn, be measured. The well-trained professional can facilitate the selection of indicators most appropriate for different levels of sustainability thinking and actions, and assist in determining how the outputs from one level affect the inputs of another level.

In summary, professionals must be able to demonstrate a reorientation to their experience and practice that includes: (a) principles, skills, perspectives, and values related to sustainability; (b) continued learning that is appropriate and relevant; (c) the ability to integrate environment, economy, and society concerns; and (d) learning the knowledge, tools and assessment of values that will guide and motivate people to participate in a democratic society and live in a sustainable manner. With the appropriate educational and continued professional development approaches, the practitioner in sustainable development should be able to bridge the gap in aligning business practices with social and environmental goals as well as assist decision-makers to both select and synergize their efforts for maximum strategic effectiveness and efficiency.

Tools to Consider in Sustainability Practice

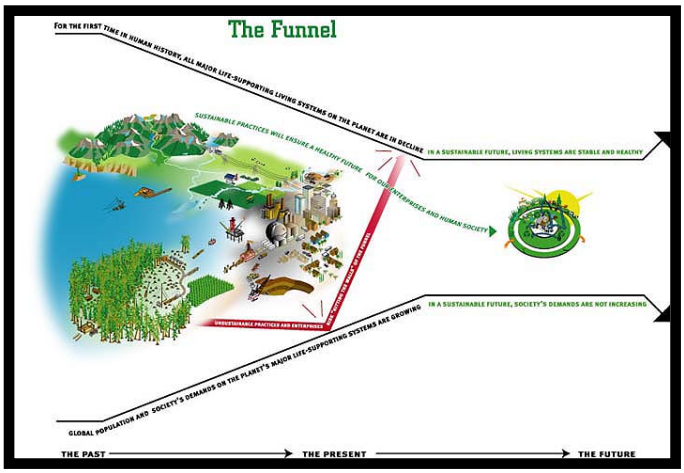
Many communities, and other kinds of organizations, lack the capability to appropriately manage the natural resources on which local livelihoods depend. They lack the know-how to assess the costs and benefits of economic development opportunities or to make well-informed decisions about development options that may be available. We must be able to better assess the link between livelihood options and sustainable resource use in order to plan and initiate development activities consistent with the sustainable management of livelihood resources and natural capital. The question is – how to move forward? – when there is apparently a gap in awareness about what sustainable

development represents, an urgency of addressing it, and the fact that existing instruments are not being used to their full potential.

Although original ideas on sustainability differ across sectors and their implications have been interpreted in many ways, the basic principles stated previously can effectively help to guide the practice of sustainable development. For example, considerations clearly include socio-economic as well as environmental (biophysical) matters and are especially concerned with the interrelations between and interdependency of these. "That means that human as well as ecological effects must be addressed (simultaneously) as parts of large complex systems" (Gibson, 2002). The leadership provided by the sustainable development practitioner becomes instrumental in providing guidance to organizations wanting to move in a more sustainable direction by his/her influencing of comprehensive, multi-dimensional approaches. And the application of processes such as citizen science and adaptive management can facilitate the planning, design, and carrying-out of sustainability actions.

There are a number of "tools" that can be used to assist practitioners and benefactors in their progress toward sustainability that will support the application of citizen science and adaptive management processes. These tools, in and of themselves, or applied in tandem, can offer guidance and understanding toward the ambitions of sustainable development.

The Natural Step (TNS) is an organizational learning tool and systems approach to practicing sustainable development which incorporates many of the sustainability principles listed previously.



TNS offers tangible targets through the establishment of four conditions that must be met in order to achieve sustainability (Robert, et al., 1997; James and Lahiti, 2004). The conditions relate to what we take, what we make, what we maintain, and whether we are fair (Nattrass and Altomare, 2002). It is important to keep a systems view in mind so that the causal factors of problems are explored (in contrast to "treating the symptoms") before proposing solutions. Solutions should be sensitive to the system parts and their interconnections (*e.g.*, social, environmental and economic), the complexities of a problem, and the consequences of making a change within the system (meeting the sustainability principles). As devised by Robert (1991), The Natural Step Four System Conditions are:

1. **How can we reduce our dependence on underground resources from mining and fossil fuels?** In a sustainable society nature's functions and diversity are not systematically subject to increasing concentrations of substances extracted from the Earth's crust. There are thresholds beyond which living organisms and ecosystems are adversely affected by these increases. This means that fossil fuels, metals, mined minerals, and

other naturally occurring substances that are systematically accumulating beyond natural levels, can not be extracted at a faster rate than they are re-deposited back into the Earth's crust.

2. **How can we reduce our dependence on persistent, non-biodegradable, unnatural substances?** In a sustainable society nature's functions and diversity are not systematically subject to increasing concentrations of substances produced by society. Synthetic organic compounds such as DDT and PCBs, plastics, ozone-depleting chemicals, waste materials, etc., can remain in the environment for many years, concentrating in the Earth's atmosphere or accumulating in the tissue of organisms, causing profound deleterious effects on predators in the upper levels of the food chain. These materials must not be produced at a faster rate than they can be broken down in nature. Society needs to find ways to reduce economic dependence on and a phase-out of persistent human-made substances not found in nature.
3. **How can we reduce our dependence on nature-consuming activities that destroy or degrade natural ecosystems?** In a sustainable society nature's functions and diversity are not systematically impoverished by physical displacement, over-harvesting, or other forms of ecosystem manipulation. Biodiversity, which includes the great variety of animals and plants found in nature, provides the foundation for ecosystem services which are necessary to sustain all life on Earth. Humans should avoid taking more from the biosphere than can be replenished by natural systems or systematically encroaching upon nature by destroying the habitat of other species. Society's health and prosperity depends on the enduring capacity of nature and its ability to rebuild waste into resources. This requires that we critically examine how we harvest renewable resources, and adjust our consumption and land-use practices to fall well within the regenerative capacities of ecosystems.

4. **How can we increase the efficiency of our resource use and do more with less to meet needs worldwide?** In a sustainable society resources are used fairly and efficiently in order to meet basic human needs globally. Humans need to be efficient and fair with regard to resource use and waste generation in order to be sustainable. Achieving greater fairness is essential for social stability and the cooperation needed for making large-scale changes within the framework laid out by the first three conditions. Economists believe in "growing the pie" so that poor people will get a "bigger slice." Even if Earth's capacity allows for growing the pie, providing a bigger slice from a larger pie to the poor is not decreasing the gap between rich and poor (fairness). It is actually increasing this gap.

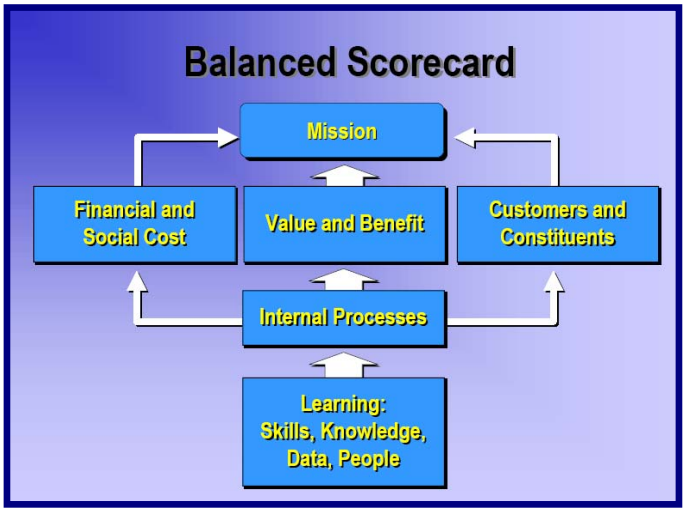
Using these 4 System Conditions can provide a "compass" to guide organizations, communities, and individuals towards sustainable practices by identifying criteria having certain thresholds that should not be exceeded. The Natural Step framework offers alternatives to the traditional way of doing business by integrating sustainability principles into core strategies, decisions, operations and the bottom line. The conditions of TNS have been used by a number of corporations and communities to evaluate their particular activities with regards to outcomes that will achieve greater sustainability.

Triple Bottom Line: For an organization (or a community) to be sustainable (a long run perspective) it must be financially secure (as evidenced through such measures as profitability); it must minimize (or ideally eliminate) its negative environmental impacts; and, it must act in conformity with societal

expectations. These three factors are obviously highly interrelated. Advocates of the "triple bottom line" believe that organizations pursuing sustainability ought to make decisions based not only on economic returns but also on environmental protection and social justice (Norman and MacDonald, 2004). For example, the three elements of the triple bottom line – economic, environmental, and social – can be combined: eco-efficiency refers to optimizing economic and environmental goals; fair trade refers to economic activities conducted with particular attention to social consequences; and environmental justice refers to social equity with respect to environmental protection. Because these objectives are important to society, advocates argue that companies should consider them in daily decisions. In support of achieving goals embodied in the Triple Bottom Line, companies will often consider the following two strategies:

- ***Corporate Social Responsibility*** is a set of sustainability strategies that range from ensuring a corporation's services meet changing customer and community needs, to the health and safety conditions available to its workforce, to what it can contribute to the community through fundraising, volunteering, partnerships and specific arrangements that can be put in place (*i.e.* social tendering.
- ***Socially Responsible Investing*****:** is the practice of public and private investing of financial capital in businesses that are sensitive to the protection of the environment and needs of society as demonstrated by the way they conduct business and the way they influence their demand and supply chain partners to practice business.

Balanced Scorecard: In today's complicated world of doing business organizations, corporations, and governmental agencies face enormous challenges in linking present actions to future goals for achieving sustainability. In most cases it is impossible for managers to set conservation and sustainability goals until they have exhausted their concerns about institutional constraints and needs that higher level organizational statements of intent mandate them to achieve. So it comes down to helping managers and employees throughout the institution empower themselves and fully understand the institutional goals to help them contribute toward the sustainability objectives of the institution.



An effective tool that can assist organizations in operational/management designs for achieving sustainability is the Balanced Scorecard (Kaplan and Norton, 1996). The Balanced Scorecard becomes an effective planning and corrective tool when an organization has breakdowns in its operational and management strategies that might include for example:

- isolated improvements not linked to strategic goals;
- cross agency problems not addressed; or
- limited use of budget decisions linked to performance measures.

The idea of the Balanced Scorecard is to carry the established vision, goals, and objectives of an organization into all niches of it's structure, with an emphasis on action that integrates the organization's mission at all levels (*i.e.*, board member to individual employee and/or volunteer). The scorecard approach offers organization managers, administrators, and boards of directors (or trustees) a way of ensuring that all levels of the organization understand the organization's long-term strategy and that both internal and community stakeholder objectives are aligned with it. The exercise of creating a Balanced Scorecard also forces organizations to integrate their strategic planning and budgeting processes and therefore helps to ensure that their budgets support their strategies. The scorecard model enables users to select measures of progress from all four scorecard perspectives:

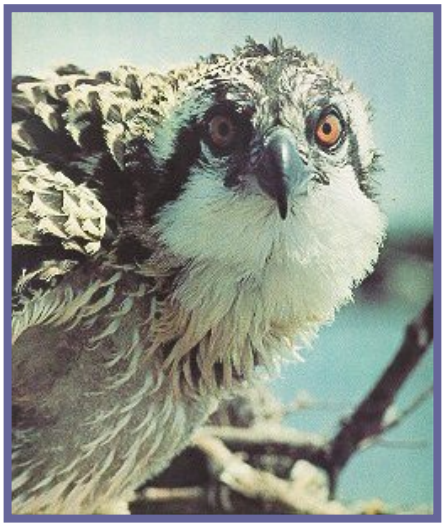
- corporate;
- business (budget office);
- team or department; and
- individual.

Then the scorecard process sets targets for each one of them. The users can determine which actions will drive them toward their targets (*i.e.*, promoting sustainability in their agency work), identify the measures they will apply to those drivers from the four above perspectives, and establish the short-term milestones that will mark their progress along the strategic paths each different level of the organization has selected. Building a Balanced Scorecard also enables an organization to link its financial budgets with its strategic goals in a comprehensive, transparent fashion.

Sustainability Competency & Opportunity Rating & Evaluation (SCORE) system: SCORE represents a powerful tool to assess your sustainable business practices and to plan future actions. SCORE was created by Darcy Hitchcock and Marsha Willard (2006) as part of their book, ***The Business Guide to Sustainability***. They wanted to create a tool that would help organizations evaluate how well they were doing on their path toward sustainability but also help the organizations understand what they ultimately would need to do. In the assessment each practice of the organization is evaluated according to three levels of performance. The Incubator level, worth one point, is better than standard business practice, representing early, often ad hoc actions. The Initiative level, worth 3 points, describes typical standards when sustainability is a formal organizational initiative. The Integrated level, worth 9 points, represents a fully (or close to fully) sustainable state where sustainability is integrated into the organization and the organization is actively using its influence to move their stakeholders toward sustainability. There are many ways to administer SCORE. It is a useful tool not only for giving you a snapshot of current performance but also for educating others about what sustainability means and how far you have to go. When conducted in a group setting, it also can help calibrate people's expectations, bringing them more into alignment. Often the conversations are more important than the numbers! SCORE assessment results are easily comparable from year to year to measure an organization's improvement. It can also represent part of a much larger assessment of the organization's performance and can also be employed to numerically measure a company's desired performance level after a specified period of time.

The U.S. **National Environmental Policy Act (NEPA):** NEPA as a statute with its implementing regulations has required U.S. agencies to at least acknowledge that there are environmental consequences of their actions. The existence and publication of NEPA Environmental Analyses (EA) or Environmental Impact Statements (EIS) have provided for much more public input into decision-making than was known previously, before NEPA was implemented (1970). But NEPA was designed

to do more. It was meant to force agencies to insure the integrated use of the natural and social sciences in planning and decision-making. NEPA explicitly states that agencies are to use an interdisciplinary approach to their work, but this is not apparent in most current EISs. The problem is that, despite years of effort and the development of university programs that claim to teach interdisciplinary environmental research, the ability to perform it in the real world of deadlines and finite resources does not yet exist. Another problem is the separation of "social" impacts from "environmental" impacts in EISs. The underlying principle of NEPA is that all impacts of a project are eventually social, as they ultimately affect people.



Environmental Management Systems (EMS): An environmental management system is that part of the organization's overall management system which includes corporation structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining an organization's environmental policy. The EMS was an outgrowth of corporations attempting to meet NEPA regulations. The presumed benefits of an EMS include:

- minimizing environmental risk liabilities;
- maximizing the efficient use of resources;
- reducing waste;
- demonstrating a good corporate image;
- building awareness of environmental concern among employees;
- gaining a better understanding of the environmental impacts of business activities; and
- increasing profit, while improving environmental performance, through more efficient operations.

In response to the complexity of environmental management and a growing demand for a systematic and comprehensive EMS procedure, the International Standards Organization (ISO) developed criteria in the early 1990s for environmental management systems. The ISO 9000/14000 series, of which ISO 14001 is the most recent (late 1996), are a set of completely voluntary standards and guideline reference documents which include environmental management systems, eco-labeling, environmental auditing, life cycle assessment, environmental performance evaluation, and environmental aspects in product standards. ISO 14001 is designed to provide customers with a reasonable assurance that the performance claims of a company are accurate because of the following:

- increases environmental compliance;
- reduces costs and liabilities;
- reduces impact on the environment;
- offers a competitive advantage; and
- demonstrates that customers prefer certified suppliers.

Environmentally Sustainable Management Systems (ESMS): Environmental management systems are gaining popularity around the world. They provide the structure for the integration of environmental issues into management and day-to-day operations that will provide the capacity to meet NEPA regulations. But they don't offer the vision that guides organizations and corporations on

the path to multi-dimensional problem-solving and sustainability. Nor do they provide the understanding of what constitutes a sustainable direction. The Natural Step (TNS) framework and consideration of the 3-overlapping circles model, however, offer the compass to better direct the activities of the traditional EMS. Through a combination of ideas and tools, a new methodology is suggested, an Environmentally Sustainable Management System (ESMS), designed after the ideas of the EMS. The ESMS then becomes a process for managing the impacts of an organization's activities on the environment by integrating elements of sustainability through the use of a variety of new tools. Once the vision and direction are set, an ESMS becomes a valuable methodology for guiding decisions, operationalizing the vision, and documenting the progress. It provides a structured approach to planning and implementing environmental protection measures that will enhance sustainability.

The Ecological Footprint: The Ecological Footprint compares the environmental impact of specific actions to the limitations of the Earth's natural resources and ecosystem functionality (Wackernagel and Rees, 1996). The Ecological Footprint calculates a ratio of "how many Earths" would be required to provide enough biologically productive land area to maintain the flows of resources and wastes, if everyone lived like a specific person or group of people. The Ecological Footprint has been implemented across a wide range of units of analysis, including a consumer product (e.g., a personal computer, washing detergent); an individual company; an economic sector; specific regions and nations; and the Earth. For example, urban economists have used the Ecological Footprint to evaluate the environmental impacts of commuting in Barcelona, Spain, as a function of transportation technology and residents' locations. The Ecological Footprint serves well to highlight global inequity in resource consumption.

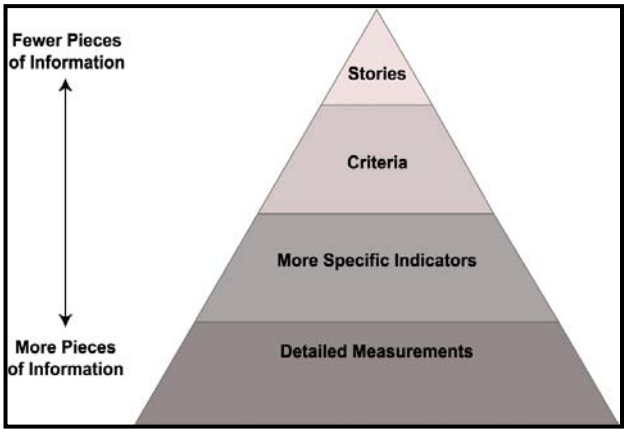
Sustainable Emissions and Resource Usage is a four-step process that can support the Ecological Footprint concept for determining a sustainable rate of resource use. The four steps are: (i) calculate the available supply of virgin materials (mass); (ii) allocate consumption of this supply over a specific time scale and among the global population (mass per person per year); (iii) account for recycling and for existing stockpiles including landfills, and then update the allocated consumption rate; and (iv) consider this rate to be the maximum sustainable consumption rate and compare it to the current usage rate. A time scale of 50 years is employed, based on the argument that a sustainable resource consumption rate must last at least two human reproductive generations, assumed to be 50 years. Sustainable emission rates are determined in a comparable manner: (i) determine the total annual global anthropogenic emissions of a particular substance that meets a political target or that is below a threshold that would cause permanent environmental change (mass); (ii) divide this total by the current global population and by 50 years to calculate an allocated emission rate (mass per person per year); (iii) account for recycle schemes such as sequestration and then update the allocated emission rate (mass per person per year); and (iv) consider this rate to be the maximum sustainable emission rate and compare it to the current emission rate. These four-step processes include several novel aspects. First, they highlight that assessing whether a consumption or emission rate is sustainable requires specifying an explicit time scale. Second, they suggest that certain rates of non-renewable resource consumption are sustainable. While considering

the depletion of a finite resource to be a sustainable action contradicts the dictionary definition of sustainability, it may be consistent with the Brundtland concept if substitutes are identified to satisfy the needs of future generations.

The Use of Indicators: Many of the tools highlighted above can benefit from a means of measuring progress and/or improvements. Likewise, communities need a believable means of setting sustainability goals and then determining the degree to which these are reached. Policy-makers also need "early warning signals" of poor performance that can enable appropriate adjustments. If we envision the context of public discourse about management as one of deciding democratically what to do, then the public must in some way contribute to the choice of goals of management. And since goals are given operational meaning by choosing which variables to track in determining the meeting of those goals, it seems to follow that there must be democratic input on the choice of indicators and on the standards that are set. This reasoning implies in turn that, in some sense, democratic participation requires that policymakers and at least some of the public can understand models chosen to determine success and failure through the use of indicators, especially since the scientific community over recent years has paid a lot of attention to indicators and integrated surrogate variables for presenting and interpreting information on environmental quality and societal health.

After a consensus is developed regarding criteria that describe the future viability of healthy resources for example, indicators to measure sustainability can be defined (Flint, 2004a). Indicators point the way and mark progress toward a community or corporation vision of sustainable development by serving as representations of measurable data which show changes over time. An indicator clarifies a problem or condition to show how well a system is working by making complex systems understandable and perceptible (tangible), in the form of measures that assess relevant information on trends in a readily clear way. Indicators can be presented in the form of numbers, charts, graphs, or maps.

An effective indicator or set of indicators helps a community for example, determine where it is, where it is going, and how far it is from chosen sustainability characteristics that reflect already established criteria and/or conditions, revealing the goals or issues that are important to the community. An indicator creates a snapshot of a resource's economic, social, and environmental system conditions and provides the opportunity to better understand past trends so that decision-makers can influence future directions of development. Generally an indicator will focus on a small, manageable, and telling piece of a system, helping people to see the bigger picture through small details. A useful indicator should allow people to track its direction and rate of change over time. The indicator should also illuminate cause-and-effect relationships, in order to understand not only what's happening, but why. A good indicator alerts one to a problem before it gets too bad and helps recognize what needs to be done to fix the problem.

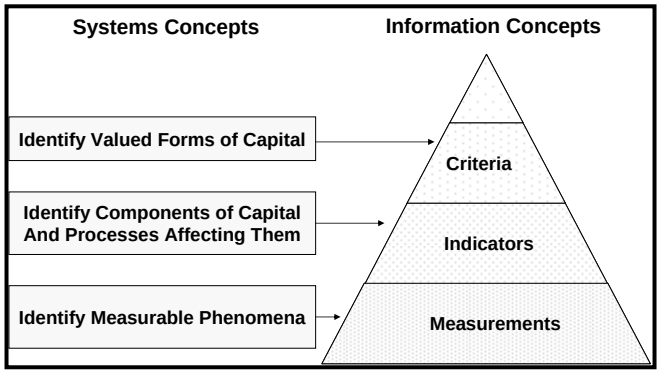


A wisely chosen indicator sends society an important signal. It tells the story that needs telling. Further, to become part of a story and to have informative value, people must be able to "get it." The adjacent

Information Pyramid shows a general concept that has become well accepted as a basis for developing environmental indicator systems (Hammond et al., 1995). It shows a hierarchical arrangement with relatively general and simple stories that most people can absorb at the top and increasing detail, specificity, and complexity at successively lower levels in the pyramid. At the top of the pyramid is the most widely communicated form of information, relatively simple stories that are told in various media (Krantz, et al., 2004). Such stories can be developed by interpreting more detailed criteria and indicators moving down the pyramid that are produced using data from measurements. The pyramid metaphor is based on the idea that there are more building blocks, more pieces of information, in the lower tiers. For example, data from measurements is the most detailed form of information and tends to be used mostly by experts.

The value of a set of systematically produced, science-based criteria and indicators is the improvement they can bring about in our shared understanding, the common knowledge of the world that we communicate in the stories we tell each other (Kranz, et al., 2004). Such improvements result from using indicators to ground our stories in science-based measurements, helping us to distinguish more realistic stories from less realistic. The actions we take in the many contexts affecting systems management are usually based on the stories that are most widely believed by the people in those contexts.

The diagram below (from Kranz, et al., 2004) illustrates a way to use the capital maintenance concept of sustainability in the development of criteria and indicators for sustainable systems management (Heintz, 2004). A set of criteria linked to capital or capacity would be identified by listening to stakeholder's core values in characterizing their future vision for a resource or system (Daly and Cobb, 1994; Wackernagel and Rees, 1996). Criteria can then be identified that establish the conditions deemed necessary to protect and sustain all the perceived beneficial uses of a system or resource's assets, its capital. In essence, criteria provide a "lens" through which to evaluate the preferred future status of the system, characteristics that best define its sustainability (Flint, et. al, 2002). For example, in the development of sustainable water resource indicators, a criterion related to a valued form of economic capital would be "maintain the capacity to supply drinking water to meet human needs" (Kranz, et al., 2004). Indicators for this criterion could be the flow capacities of systems that supply water for human consumption and the quality the water they deliver for human consumption. Water flow capacities could in turn be measured by determining variations of flow rates in rivers and streams, and water levels in reservoirs over time. Multiple measures of levels of turbidity, chemical pollutants, and other contaminants could be used to determine whether the quality of drinking water is sufficient for human consumption.



Indicators of sustainability examine a resource's long-term viability based on the degree to which it's economic, environmental, and social systems are efficient and integrated in serving community goals. But, indicators of sustainability are not the traditional indicators of economic success or environmental quality. Because to achieve sustainability requires a more integrated view of the world, indicators of

sustainability link economy, environment and society, and point to where these links are weak. For example, an economic indicator that does not include environmental and social effects will not help move water resource protection in a sustainable direction (*e.g.*, the Missouri River conflict; Quaid, 2003). Likewise, an environmental indicator that does not take into account economic and social impacts will not provide adequate insight into the best way to improve water resource health and vitality. A perfect example of what is being said here is the following: when the Exxon Valdez tanker ran aground, the spilled oil killed millions of animals and cost millions of dollars to clean-up. The jobs created from clean-up activities made the U.S. Gross National Product (GNP), a much-relied upon national economic indicator, go up (Flint and Houser, 2001). In this case, using the GNP as an isolated indicator suggests we should get more oil tankers to run into rocks more often.

Indicators can tell decision-makers and society in general how we are doing toward the achievement of sustainable development. Indicators represent standards for measuring characteristic criteria (conditions) of sustainability. And, indicators are as varied as the types of systems they monitor. Before time is spent gathering and reporting data for an indicator, however, it should be compared to the community's perception of sustainability to make sure that the chosen indicator is measuring the right thing. For an indicator to be effective, its quality, source and reliability – in short, its integrity – must be scientifically defensible. Otherwise, people won't trust it. The integrity of an indicator must be perceived as being "above the fray" to insulate it from criticisms of special interests who may deny the trend it suggests and oppose the decisions it implies (Krantz, et al., 2004). There are certain characteristics that effective indicators have in common:

- Relevant to sustainability and link economy, society, and environment.
- Developed and accepted by the people in the community.
- Understandable to the community at large and reflect stakeholder's concerns: important to the lives of the audience.
- Attractive to the media and can be used to monitor, analyze, and communicate local trends.
- Accurately measure the issue or goal in a scientifically defensible way.
- Focus on a long-range view; reliable up to two decades or more.
- Flexible enough to incorporate new scientific information and changing public perceptions.
- Can be compared to existing and past measures to define trends and identify stresses.
- Advances local sustainability, but not at the expense of other regions.
- Measures an appropriate geographic area and/or an appropriate time interval.
- Provides early warning of changes.
- Can measure movement towards or away from a specified target/goal.
- Based on reliable and timely information that is easy to gather at modest cost.
- Outcome (results) oriented: focuses on measuring achievements instead of efforts or expenditures.

After identifying key indicators and corresponding data bases, we must conduct the exercise of setting benchmarks for each indicator. A benchmark is a data point along the complete range (spectrum) of

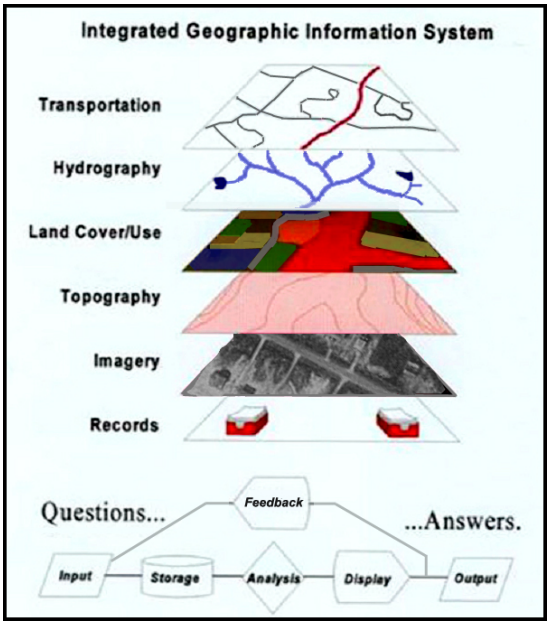
the indicator measures, something that serves as a standard against which to make measurements, that action strategies target for interim indications for meeting objectives of an improvement program.

Sustainability indicators tell us "where we are" in the quest for short- and long-term equilibrium between social, economic and ecological needs. They highlight important trends and help us begin to evaluate their causes and effects. They educate people and build awareness about the challenges we face. They give us a common language that allows us to share a deeper understanding of issues and forge the collective responses that every level of society must take.

Geographic Information Systems: A Geographic Information System, or GIS, is a computer-based approach to collecting, storing, and analyzing data that have spatial characteristics. A GIS can be thought of as a collection of electronic maps, stored in a computer database, which allows a wide range of analysis and product generation. A GIS stores data that is primarily geographical in nature. Geography, as defined by Webster's University Dictionary, is the study of the earth and its features and the distribution of life on the earth. A GIS stores information about these subjects including the location and other detailed descriptions or attributes, thus integrating knowledge from different disciplines, such as the following, within the context of the Earth's surface:

- geography
- environmental science
- newer fields like global change, integrated assessment

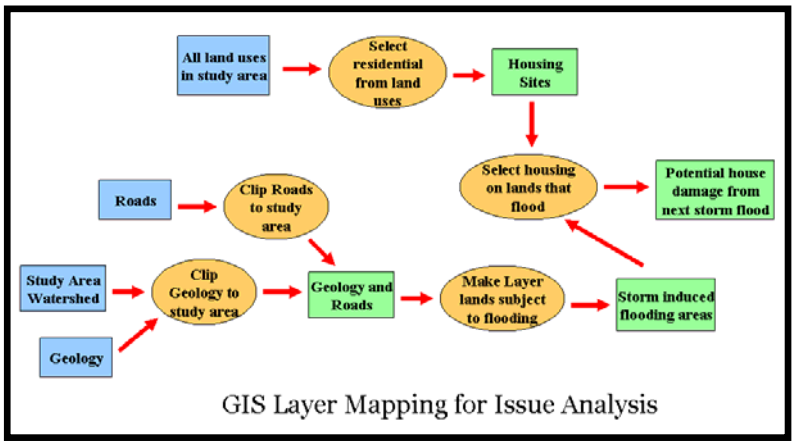
Capturing and storing the location of things or events on the surface of the Earth allows the GIS to display and analyze spatial relationships. The spatial locations in a GIS are simply defined by X,Y coordinates such as latitude and longitude. Spatial locations can show where the features are located and also define the shape of the feature. An evaluation of change in map patterns is a key benefit of using GIS analyses. One can map the change in an area to anticipate future conditions, decide on a course of action, or to evaluate the results of an action or policy.



1. Map where and how things move over a period of time. In this way one can gain insight into how they behave. For example, a meteorologist might study the paths of hurricanes to predict where and when they might occur in the future.
2. Map change to anticipate future needs. For example, a police chief might study how crime patterns change from month to month to help decide where officers should be assigned.
3. Map conditions before and after an action or event to see the impact. A retail analyst might map the change in store sales before and after a regional ad campaign to see where the ads were most effective.

Asset mapping can be an important technique for collecting "heart and soul" features of a community. While you can see landscape characteristics of a place by simply drawing the locations of features on a paper map, it is impossible through this means to work with the full complexity of a landscape. Roads,

buildings, utilities, vegetation, habitats, elevation and many more data components must be available on a map for it to be useful in the planning process. Even more helpful is the ability to apply a GIS in order to overlay all these important landscape features to quantify position, concentration, cultural value, relationship, and interaction among features. Combination of the multifaceted conditions across the region can be integrated together to form a better view for the planning process. With maps specific to local conditions people can work collaboratively to improve and continuously update their understanding of what their community and surrounding environment really look like, as well as what potential assets they possess that will be important in planning for the future.



GIS Layer Mapping for Issue Analysis

The capabilities of GIS, as generally illustrated by the example in the diagram below, can be used to conceptually integrate the data for different group perspectives on possible future scenarios for landscape development to do spatial analysis on the data and use the mapping displays to address complex geographic issues delineated by the different group scenarios (*e.g.*, housing development, business placement, and other land use development in relation to the storm hazard of flooding).

The use of simple GIS modeling can provide periodic instances of graphic landscape-grounded versions of current and future conditions. For example, remote sensing is an important technique for monitoring land cover changes over broad areas in a synoptic, relatively inexpensive, and dependable way. Such information, when assimilated into GIS and integrated with ground-truth transport and process-oriented information on ecosystems, allows us to relate land cover and changes in land use to effects on living resources and thus, guide application of potential restorative approaches or further protective strategies for threatened systems. Through this process community stakeholders can play "what if" scenarios for their community by testing alternative choices in land use, transportation, water quality, waste management, economic strategies (*i.e.*, eco-tourism versus small-scale industrial development). During the scenario planning process (some refer to this as "futuring") stakeholder participants can also identify problems they perceive from the different scenarios being examined. Following the futuring scenario comparisons there is the opportunity for developing consensus on the development course judged most appropriate and sustainable by stakeholders. Through their identification of problems related to the different scenarios, participants are then able to identify solutions that can be built into a future comprehensive planning process in order to advance the community's preferred path of development. As a final element of any futuring process stakeholders can use their collective wisdom gained from scenario comparisons for identifying indicators of success that can be used to evaluate progress on the publicly preferred strategy direction.

Conservation-Based Development: Regional land development activities done in isolation or segregated from one another, not thinking equally about natural resource conservation, economic security, and social well-being for all, which result in sprawl across the rural landscape, cause a number of major problems including:

- destroying the economic and environmental value of resource lands;
- creating an inefficient land-use pattern that is very expensive to serve;
- threatening economic viability by diffusing public infrastructure investments;
- destroying the intrinsic visual and functional character of the rural landscape; and
- eroding a sense of community.

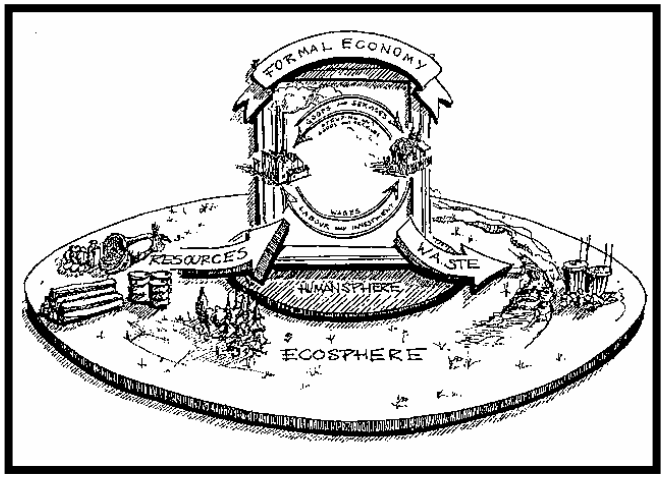
Conservation-based development is the practice of integrating environmental and social issues into the meeting of economically viable mixed-use development of both urban and rural landscapes (Arendt, 1996). The concept of conservation-based development covers many different issues: from the environmentally sound use of rural lands, to the protection of natural, ecological, and agricultural resources, to the maintenance of small town and village integrity, to the assessment of urban sprawl consequences. Conservation-based development can effectively deal with and anticipate impacts of urban sprawl on adjacent rural districts. The intent in using this strategy is to integrate the valuable natural assets of a region with related economic and other development objectives toward sound, "win-win" scenarios of community improvement. Conservation-based development practices will help a developer to:

- make thoughtful choices about where new development should/should not go, to improve water quality and natural habitat protection;
- understand how good environments (open space preservation; coastal bay ecosystem health; forested and agricultural land protection, etc.) will in-turn support healthy economies (value-added agriculture; eco-tourism; enhanced commercial fisheries, etc.);
- formulate rational strategies for using already developed land and resources more efficiently to enhance community revitalization;
- link land-use development with conservation and protection of economically valuable watersheds;
- develop rural, sustainable communities through grassroots empowerment and enhancement of social and cultural assets;
- set up regulatory mechanisms that are fair, clear, consistent, and far-sighted; and
- offer a better quality of life in an equitable way for all citizens of the region.

Leadership in Energy & Environmental Design (LEED – Green Building): A voluntary, consensus-based, market-driven building rating system based on existing proven technology for efficiency and minimal

environmental impact. It evaluates environmental performance from a "whole building" perspective over the life cycle of the building, providing a definitive standard for what constitutes a "green building."

Life Cycle Analysis (LCA) shows the 'world behind the project, product, or service and the varying impacts of different alternatives on the environmental, as well as in the case of project analysis the social and economic sectors. Life cycle analysis (LCA) is an important "proactive" management technique. LCA is a "systems approach" investigation which aims to quantify the level of energy and raw materials used, the solid, liquid, and gaseous wastes produced, and consider the socio-economic issues around these pathways of resource flow at every stage of a project or a product's life or process, identifying environmental and socio-economic impacts before they happen (Hunt, et al., 1992). In contrast, end-of-project assessment or other after-the-fact, reactive techniques generally have been unable to offer the potential benefits that can be achieved with preventable techniques such as LCA. LCA can also lead to the concept of "full cost accounting." The idea of full or total cost accounting is a way of accurately reflecting both the benefits and costs of natural, human, and financial resource use, as well as product manufacturing benefits and costs.



Industrial Ecology: Industrial Ecology is now being seriously considered by many businesses as a holistic and integrative approach to the traditional take-make-waste practices. This idea uses the metaphor of metabolism to analyze production and consumption by industry, government, organizations and consumers, and the interactions between them. It involves tracking energy and material flows through industrial systems (*e.g.*, a plant, region, or national or global economy), from the standpoint that instead of cradle to grave views, companies are now considering cradle to cradle perspectives, where waste from one process is food for another (McDonough and Braungart, 1998). In this approach, cleaner production is the continuous application of an integrated, preventive environmental strategy applied to processes, products, and services to increase eco-efficiency and reduce risks for humans and the environment. It applies to:

- production processes: conserving raw materials and energy, eliminating toxic raw materials, and reducing the quantity and toxicity of all emissions and wastes;
- products: reducing negative impacts along the life cycle of a product from raw materials extraction to its ultimate disposal; and
- services: incorporating environmental concerns into the designing and delivering of services.

There are several strategic tools that support the implementation of industrial ecology principles. These include the following:

- ***Eco-efficiency*** is doing 'business as usual' with a reduced impact. It means achieving more efficient use of resources for each dollar earned (McDonough and Braungart, 1998). Eco-efficiency improvements are an excellent starting point for any organization. There are seven ways to achieve eco-efficiency:

- reduce the material intensity of goods and services,
- reduce the energy intensity of goods and services,
- reduce toxic dispersion,
- enhance material recyclability,
- maximize sustainable use of renewable resources,
- reduce material durability, and
- increase the service intensity of goods and services.

Related to the idea of eco-efficiency which when practiced move the project or program toward the next level of eco-effectiveness are the concepts of:

- Resource productivity or Factor 4 aims for greater productivity through more efficient use of resources, often through technical or process innovation. The book "Factor 4" provides 50 examples that show how we can quadruple the amount of wealth extracted from one unit of natural resources, demonstrating that we can live twice as well yet use half as much. Examples include efficient commercial buildings, household appliances, and office equipment, as well as reuse of chemicals, longevity and repairability of products, remanufacturing and recycling. The drastic decrease of transport intensities is also an option in many cases.
- Lean thinking involves eliminating waste by focusing on how value is created. Waste in this context means not only material waste, but also process waste (*e.g.*, unnecessary steps, delays) and waste that builds up through inefficient ways of delivering value (*e.g.*, inventory build up, timeliness of response).
- Zero emissions and zero waste approaches aim for businesses to do more with less until everything is done without producing waste. It involves transforming materials once thought of as waste into new products. Zero waste aims to achieve zero solid waste, zero hazardous waste, zero toxics, and zero emissions and discharges.

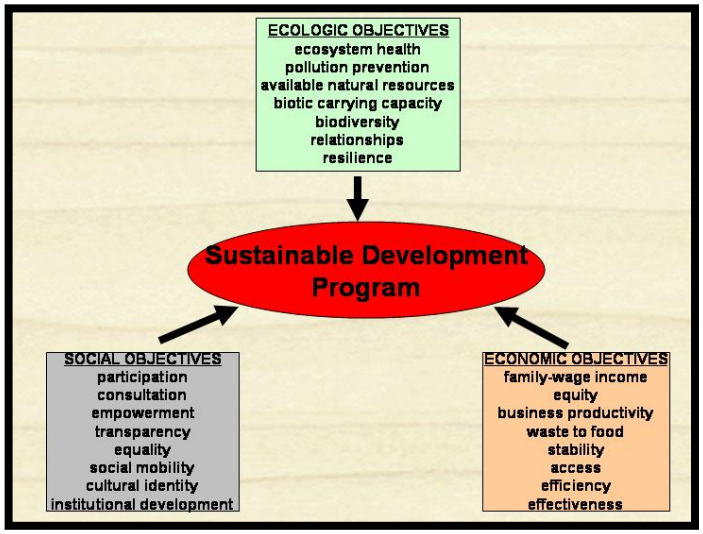
- ***Eco-effectiveness*** is the most recent development since eco-efficiency, and promotes smarter design of products and services in the first instance, rather than the "reducing, avoiding, minimizing" approaches of eco-efficiency (McDonough and Braungart, 1998). It is concerned with the absolute impacts. It aims to produce the right thing, the right service, the right product, the right system, rather than making the wrong thing less bad. Eco-effectiveness changes our "take-make-waste" strategy to a "borrow-use-return" strategy that sees all waste as food for another product or process.

Sustainability means transforming our ways of living to maximize the chances that environmental and social conditions will indefinitely support human security, well-being, and health (McMichael, et al., 2003). In summary, we will achieve sustainability when we understand the economic, social, and environmental consequences of our actions and make deliberate choices that allow all people to lead healthy, productive, and enjoyable lives, now and in the future, without experiencing unintended consequences. These tools can assist our understanding and guide our actions.

Testing for Sustainability

Prevailing decision-making on undertakings of almost all kinds, public and private, typically considered only economic, technical, and perhaps political factors. But society is increasingly demanding preventative approaches to environmentally and socially regrettable undertakings as well. Sustainability, as presented in earlier parts of this manuscript, is seen as a means of expanding the emphasis of considerations in decision-making that provides a more comprehensive assessment of the many multi-dimensional problems society faces today toward achieving more sound solutions. Even when its formal role is advisory, it offers a better means of understanding options and making decisions than traditional methods. This has become more obvious as the character, scope, and multi-dimensional nature of design, implementation, and evaluation of problem-solving strategies that begin to address sustainability have expanded. There is a growing literature, a wide variety of sustainability applications, and a host of useful tools and methodologies. Nevertheless, the central principles are not well elaborated or applied. This is in part because we are just beginning and in part because seeking sustainability means challenging conventional assumptions and practices (Gibson, et al., 2005).

The concept of sustainability has been presented as a coming together of human and ecological concerns, as described earlier in the form of the overlapping circles or the 3-legged stool (most often social, economic and ecological) representing areas of concern often in opposition but requiring reconciliation. But sustainability is not a science, although its achievement is based upon the understanding and implementation of good science from many different disciplines. Sustainability is instead a philosophy or culture that guides the decision-making of individuals, groups, corporations, and governments in order that they may harmoniously coexist in a manner that maintains wildlife, wildlands, decent environments, social equality, cultural freedom, economic well-being, and national security today and for future generations. The philosophical foundation of sustainability is established by the theory and principles presented previously in this document that embrace the following beliefs:



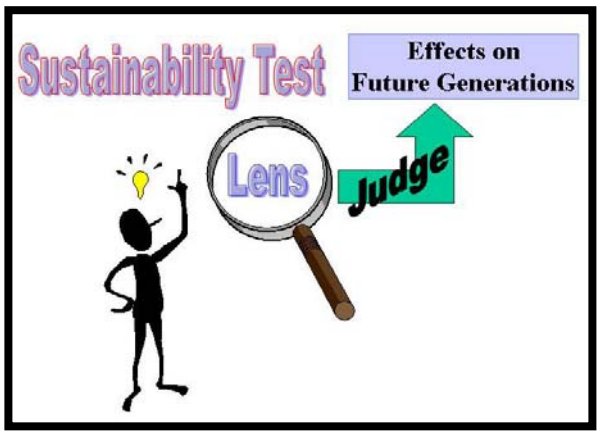
- all the things that humans care about in their daily lives are connected;
- we must recognize the limits to our world and successfully navigate within those limits – the thought that good habits come from restriction and limitation is often a catalytic force for great new ideas;
- a healthy and productive environment, its natural resources, and the services to all life that it provides, is absolutely essential for the sound socio-economic well-being of humans;
- the majority of humans are disconnected from the environment, and yet we must begin to see ourselves as part of the ecosystem in order to understand that many important elements combine to influence the global state of affairs;
- respect for different "ways of knowing" when focusing on world views that support various attitudes and actions are important because they shed light on how people relate to the world

around them, what has meaning for them, and their beliefs about what lies within and beyond their control;
- there is much to be learned from previous generations and past civilizations; and
- we always have concern for the well-being of future generations.

The failure of any organization or institution to acquire a legitimate leadership role over the issues discussed at the Earth Summit in 1992 (Gibson, 2002) and the World Summit on Sustainable Development in 2002 has resulted in a plethora of organizations offering their own sustainability definitions and metrics. The absence of a strategic process to evaluate the sustainability implications of current decisions or the implementation of projects has rendered the term sustainability meaningless from an operational perspective, distracting from the need to achieve more sound comprehensive solutions to the pressing socio-economic concerns and environmental degradation in today's world. In essence, how do we differentiate sustainable goods, services, or programs from those that are merely more environmentally friendly than the average? Likewise, what differentiates a sustainability indicator from a quality of life indicator (Marshall and Toffel, 2005)?

What is truly required is an evaluation framework for categorizing programs, projects, policies, and/or decisions as having sustainability potential. The essential immediate effect of a shift to sustainability-based criteria is an expansion of our main concern from avoidance of significant adverse (negative) effects on socio-economic or environmental issues in isolation from one another to expectation of positive contributions to the achievement of multi-sector sustainability objectives, however vaguely specified (Gibson, et al., 2005). To avoid future confusion, it should be noted that the sustainability testing protocol discussed below are different and apart from those evaluation tools discussed in the last section of this manuscript that focus strictly on assessing the sustainability capacity of organizations only (*e.g.*, SCORE, Balanced Scorecard, etc.).

Screening for Sustainability Potential: With growing popularity and reliance on sustainable development for achieving the broad goals of society, there is an increasing need for assurance of an organization or individual's ability to achieve intended sustainability outcomes by the projects or programs they design and implement in light of their stated multi-sector commitments, policies, and strategies. In this regard assurance means being certain in the mind, free from doubt, or inspiring confidence. The objective of the possible approach to an assessment protocol described below is to assist practitioners and decision-makers in developing more informed choices for taking action by evaluating the large-scale impacts that might result from a defined project or program, while also demonstrating the desire to promote accountability for sustainable action-taking. This can be extremely important and informing for stakeholders concerned about specific socio-economic and environmental aspects of any multi-sectoral issue, in which practitioners address their work from a range of relevant experience and qualifications that truly necessitate an across-discipline approach to problem-solving. The process described below is simply presented as "food for thought." Hopefully it will continue an already begun, but isolated, dialogue toward evolution of a protocol to test the merit of initiatives for moving society toward sustainability objectives.



In order to assist and guide stakeholder/organizational assessment of activities intended to promote effective sustainable development, tools and methodologies for project/program appraisal must be designed that document an integrated approach, using a comprehensive "sustainability test" or "filter" through which projects, actions, campaigns, and compromises or trade-offs can be evaluated to determine their potential for achieving sustainability goals. This testing process must cross the boundaries of environment, economics, and society to truly address issues that are not only sustainable but that will also provide positive programmatic outcomes, moving stakeholders and benefactors closer to the multi-sector character of sustainability.

One way that sustainability can be translated into practice is through a process of triangulation in which a problem is analyzed from a number of different perspectives; a multi-dimensional process that includes economic, social, political, psychological, ecological, and technical considerations. The new world view guiding sustainability theory into practice includes the following components.

1. A tri-partite model integrating economic, social, and environmental goals and requirements.
2. Ecological footprint measurement, to better evaluate how we are approaching or overshooting the very tangible threshold of Earth's carrying capacity by a program of action.
3. Life cycle thinking and management.
4. "Total cost" analysis and decision-making – making visible (transparent) the impacts and costs often treated as externalities in our current economic systems.
5. A community core value creation continuum whereby rather than exercising a "trade-off mentality," greater return and value result from more proactive and comprehensive integration of economy, environment, and social needs.

Sustainable development means transforming our ways of living to maximize the chances that environmental and social conditions will indefinitely support human security, well-being, and health. This transformation is influenced by

- awareness of sectoral relationships (broadly categorized as natural, human, and fiscal capital) and the multi-dimensional impacts (environmental, social, and economic) of any decision (3-overlapping circles),
- recognizing need for synchrony among the different dimensions across sectors, themes (3-legged stool), and scales of place and time,
- taking the required action to tackle all component sectors at the same time – benefiting from their connected, mutually supporting, constructive steps – and
- concern for the well-being of future generations (the ideas represented in the The Natural Step).

In other words, sustainability equates to thinking and acting as suggested by the 3 Cs: recognizing and acknowledging that everything of concern to us is somehow connected and purposely considering these multi-dimensional connections in our lives when faced with making choices so that unintended consequences from our actions do not undermine future environmental, social, or economic health (well-being). When evaluating the characteristics of a project or program in order to "test" for its sustainability, the 3 Cs are critical to establishing the philosophical approach behind such an appraisal.

Avoiding Compromises And Trade-Offs: To-date, sustainability assessment has been viewed as a means of adding environmental and/or social equity considerations to predominantly financial, technical, and political decision-making processes, and encouraging some adjustments to traditional objectives in the

interests of avoiding serious societal or environmental harm (Gibson, et al., 2005). We need substantial improvements in this process, however, to better guarantee sound action-taking that avoids the perils of continued unsustainable behavior resulting from isolated, sectoral approaches.

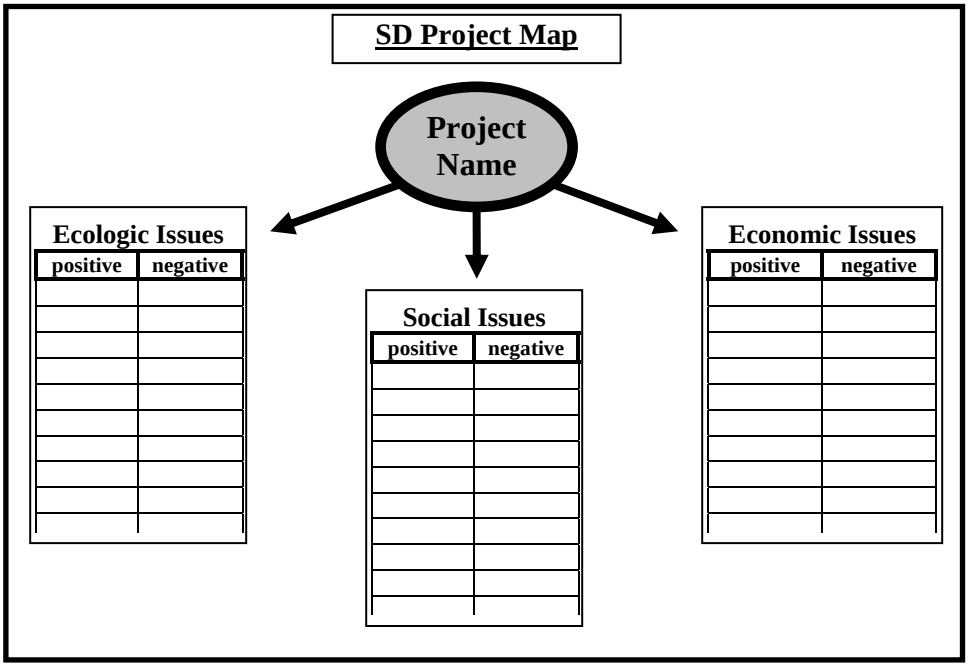
Unfortunately, today you still hear debates about the issue of "jobs versus the environment" implying that those conflicting sectors view the need for compromises and trade-offs. But we are beginning to observe many instances where economic concerns are moving beyond the "trade-off mentality" to achieve gains in both environment and economies (Flint, 2004b). Consider the following as an illustration of the new world view component number 1 (above), using a tri-partite approach. More restaurants are banking on sustainable cuisine (Kreitz, 2002). (**1**) Procurement of more environmentally friendly ingredients helps many restaurants attract customers, adding to their economic bottom line. (**2**) "Greening" restaurant buildings and purchasing products that are organically produced, or in the case of fish, caught by hook-and-line, supports low-impact environmental activities. And, (**3**) the social benefits are tremendous, from healthier eating, to support of local communities by the act of purchasing locally, providing more local job opportunities.

As Gibson (2002) emphasizes, society should avoid trade-offs and compromises in assessing the potential for sustainability of projects and programs because evaluation of progress toward sustainability should consider a time horizon long enough to capture both human and ecosystem time scales, thus responding to current short-term decision-making needs as well as those of future generations. And at what time can we make that compromise with full knowledge of the potential longer term ecological responses? This strongly suggests that we always keep in mind the fact that both social and ecological improvements often involve immediate costs while the benefits may be distant and distributed beyond the initial investors (Gibson, 2002). If compromise is a consideration, Gibson (2002) offers some general rules for considering compromises and tradeoffs that might assist in equally judging multi-sector concerns.

The Sustainability Assessment Protocol: So how do we test for the sustainability of a project, program, or campaign? How to apply the full scope of sustainability criteria is a recognized present challenge. In the assessment process systemic attention must always be the focus at evaluating the different sectoral components, ecological, socio-economic, or cultural, of any sustainability issue. Decisions must be based upon evaluations of positive as well as negative effects, enhancements as well as mitigations, uncertainties as well as confident predictions, and holistic as well as particular interrelations (Gibson, et al., 2005). Ideally, a test for sustainability should favor efforts by advocates and evaluators to implement projects that offer positive outcomes for all sectors of sustainability. This can best be achieve through a multi-dimensional approach to assessment that is iterative, and sometimes duplicative, in order to adequately address the multitude of sectoral issues involved in any particular project or program evaluation.

The **first element of testing** is to understand the different interconnected relationships of a project, program, or decision by developing a "Project Map." Development of this map can be assisted by our

acknowledgement that there are ecologic (environmental), social, and economic objectives that collectively advance sustainability. In doing so we avoid simply examining "types of undertaking" without attention to their specific ecological and socio-economic contexts, which otherwise might miss some of the most important factors affecting eventual success. In addition, examining types of individual undertakings neglects the potential collective significance of undertakings that by themselves are individually inconsequential (Gibson, 2002). Since there are sector objectives in acting sustainably, then we should be able to map the potential positive and negative impacts of a project across these different sectors. This process can provide reasonable awareness of the relevant conditions and influences of the project on sustainability criteria. It can be guided by application of Life Cycle Analysis (LCA) and/or Ecological Footprint evaluations. For example, the systems approach of LCA can quantify the level of materials and resources used, wastes produced, and socio-economic issues around these pathways at every stage of a project, identifying environmental and socio-economic effects before they happen.



The result of this impact mapping process will identify the potential positive and negative effects of the proposed effort on the ecologic, social, and economic sectors if the project is implemented in its present design. In other words, project mapping should provide an in-depth understanding of what the project is all about. With this greater awareness of the potential project outcomes, its design can be re-evaluated to explore alternatives in design that will eliminate negative impacts.

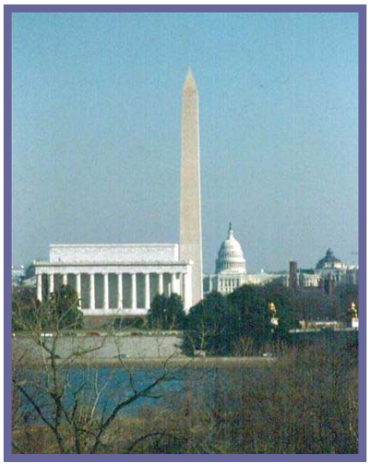
Delineation of a proposed project's impacts on each sector can be further scrutinized in order to develop a better understanding for the connections or sectoral relationships intrinsic to the operation that are important to consider in further sustainability testing of this project before carrying it out. Toward this intent Gibson (2002) provides a set of questions (which are repeated below) as an example of sustainability-based criteria for evaluating a project's effects.

1. Could the effects add to stresses that might undermine ecological integrity at any scale, in ways or to an extent that could damage important life support functions?

2. Could the effects contribute substantially to ecological rehabilitation and/or reduce stresses that might otherwise undermine ecological integrity at any scale?
3. Could the effects provide more economic opportunities for human well-being while reducing material and energy demands and other stresses on socio-ecological systems?
4. Could the effects reduce economic opportunities for human well-being and/or increase material and energy demands and other stresses on socio-ecological systems?
5. Could the effects increase equity in the provision of material security and effective choices, including future as well as present generations?
6. Could the effects reduce equity in the provision of material security and effective choices, including future as well as present generations?
7. Could the effects build government, corporate and public incentives and capacities to apply sustainability principles?

8. Could the effects undermine government, corporate or public incentives and capacities to apply sustainability principles?
9. Could the effects contribute to serious or irreversible damage to any of the foundations for sustainability?
10. Are the relevant aspects of the undertaking designed for adaptation (*e.g.* through replacement) if unanticipated adverse effects emerge?
11. Could the effects contribute positively to several or all elements of sustainability in a mutually supportive way?
12. Could the effects on any element of sustainability have consequences that might undermine prospects for improvement in another?

The **second element of testing** is to evaluate the different institutional/organizational entities important to project sustainability and assess their inter-relationships. In community-based development projects there may be a number of organizations or institutional elements (*e.g.*, governmental agencies or NGO entities) that have responsibility for implementation, either through funding, direction (oversight), or direct community facilitation. In order to assess the level of integrated, holistic leadership of a project and determine the degree of support (partnerships) from integral organizations, the connection between organizations and/or directorates in advancing the sustainability of a project should be assessed through the development of an organization-project implementation matrix. This matrix can illustrate the inter-relationships of various organizations and their contribution to the overall project or set of projects to derive a better sense for shared responsibility. Furthermore, this assessment can identify institutions not involved in the conduct of the project whose absence might jeopardize achieving sustainability.



The **third element of testing** any project, program, or decision for its capacity to achieve sustainability is to apply The Natural Step (TNS) framework to the major project components. The impact mapping

process from above can be used in conjunction with TNS to keep a systems view in mind so that the causal factors of problems are explored before proposing solutions. In this way one can feel more assured of addressing the cause of the problem rather than only treating the symptoms that we observe as a result of the underlying causative agent. TNS encourages the taking of a systems view and looks for those key "triggers" in our world that are at the foundation of biophysical degradation. TNS defines a sustainable project/program as one where four conditions are met, as described previously. In this way TNS examines the potential underlying causal factors of problems that development intervention is trying to cure before proposing specific solutions. Thus, solutions can be sensitive to system parts, their interconnections, their complexities, as well as the consequences of making a change within the system. Using these 4 system conditions can provide a "compass" to guide organizations, communities, and individuals towards sustainable practices.

The **fourth element of testing** for sustainability of a project, program, or decision is to employ the Sustainability Hierarchy framework of Marshall and Toffel (2005). In this evaluation the label "unsustainable" refers to several distinct but related concepts, which can be categorized as four levels in a Sustainability Hierarchy:

- Level 1: Actions that, if continued at the current or forecasted rate, endanger the survival of humans.
- Level 2: Actions that significantly reduce life expectancy or other basic health indicators.
- Level 3: Actions that may cause species extinction or that violate human rights.
- Level 4: Actions that reduce quality of life or are inconsistent with other values, beliefs, or aesthetic preferences.

Each level refers to a broad array of issues with spatial scales ranging from local to global. Levels 1 and 2 cover the survival and basic health of people; level 3 addresses species extinction and human rights; level 4 refers to values not covered elsewhere in the hierarchy, such as the desires for robust ecosystems for recreational use, the preservation of open space for aesthetic reasons, and social justice and equity. By deciding whether a project, program, or decision will involve actions that may cause unsustainable conditions for any of these four levels, the sustainability assessment process can easily add another dimension to the overall evaluation effort, analogous to the hierarchy of human needs defined a number of years ago by Maslow (1954). He ordered five kinds of human needs, from basic to more sophisticated. Similarly, using the Marshall and Toffel (2005) hierarchy as part of this sustainability assessment process, basic environmental well-being forms the foundation (level 1) of sustainability evaluation, and successive levels refer to increasingly higher-order sustainability needs that incorporate health, quality of life, and value-laden concerns. This perspective is similar to the directionality of sustainability elements discussed previously.

In this framework an action can be considered sustainable on one level, while unsustainable at another. In the assessment consideration needs to be given to which sustainability level is the focus when labeling an action as sustainable or unsustainable. This hierarchical assessment approach can also highlight interrelationships among

levels. For example, increasing poverty rates (a level 3 issue) can lead to widespread use of agriculturally marginal lands, causing environmental decay that reduces agricultural yield and potentially causes wide-spread famine (a level 1 issue – Petschel-Held, et al., 1999). A level 1 environmental change that endangers people's survival (*i.e.* inability to grow food because of desertification or flooding) can cause people to relocate, possibly becoming refugees, which can cause severe political and economic instability (a level 3 issue – Homer-Dixon, 1994).

A **fifth element of testing** projects or programs for their ability at addressing sustainability concerns involves the application of the "Seven Questions to Sustainability" proposed by Hodge (2004). This evaluation includes a focus upon engagement, people, the environment, the economy, traditional and non-market activities, institutional arrangements, and integrated assessment combined with continuous learning. These questions are listed here but can be reviewed in detail in the publications of Mining, Minerals and Sustainable Development North America (2002) and Hodge (2004).

1) **Engagement.** Are engagement processes in place and working effectively? Are processes of engagement committed to, designed, and implemented that:
    - ensure all affected communities of interest have the opportunity to participate in the decisions that influence their own future; and
    - are understood, agreed upon by implicated communities of interest, and consistent with the legal, institutional and cultural characteristics of the community and country where the project or operation is located?

2) **People.** Will people's well-being be maintained or improved? Will the project/operation lead directly or indirectly to maintenance of people's well-being (preferably an improvement):
    - during the life of the project/operation; and
    - at the conclusion of the project?

3) **Environment.** Is the integrity of the environment assured over the long term? Will the project or operation lead directly or indirectly to the maintenance or strengthening of the integrity of biophysical systems so that they can continue over the long-term to provide the needed support for the well-being of people and other life forms?

4) **Economy.** Is the economic viability of the project or operation assured, and will the economy of the community and beyond be better off as a result? Is the financial health of the project and responsible party assured and will the project or operation contribute to the long-term viability of the local, regional and global economy in ways that will help ensure sufficiency for all and provide specific opportunities for the less advantaged?

5) **Traditional and Non-market Activities.** Are traditional and non-market activities in the community and surrounding area accounted for in a way that is acceptable to the local people?

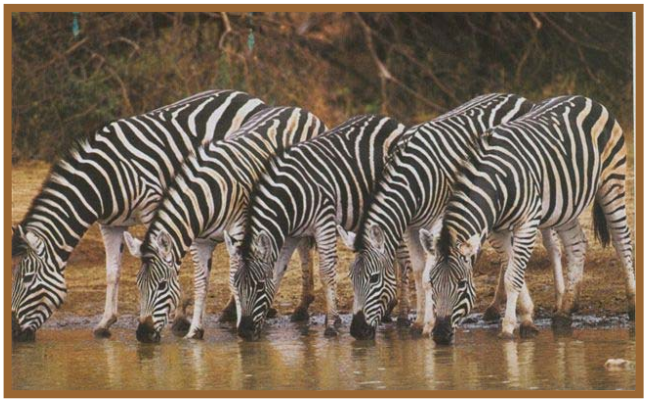
Will the project or operation contribute to the long-term viability of traditional and non-market activities in the implicated community and region?

6) **Institutional Arrangements and Governance.** Are rules, incentives, programs and capacities in place to address project or operational consequences? Are the institutional arrangements and systems of governance in place that can provide certainty and confidence that:
   - the capacity of government, companies, communities and residents to address project or operation consequences is in place or will be built; and
   - this capacity will continue to evolve and exist through the full life-cycle of the project, including after it is over?

7) **Overall Integrated Assessment (Synthesis) and Continuous Learning.** Does a full synthesis show that the net result will be positive or negative in the long term, and will there be periodic reassessments? Has an overall evaluation been made and is a system in place for periodic re-evaluation based on:
   - consideration of all reasonable alternative configurations at the project level (including the no-go option in the initial evaluation);
   - consideration of all reasonable alternatives at the overarching strategic level for supplying the commodity and the services it provides for meeting society's needs;
   - a synthesis of all the factors raised in this list of questions, leading to an overall judgment that the contribution to people and ecosystems will be net positive over the long term?

The **final element of testing** for sustainability applies the overlapping-circle Sustainability Model previously discussed. By employing the overlapping 3 circles approach, using the results of the "project mapping" exercise from above, we can test a project or program's operations and guarantee each activity implemented will simultaneously address issues of economics, social well-being, and environment (Flint, 2004b). Summarize the sustainability scope for any project or program by asking:

- Does this activity provide economic benefits? What are they?
- Does this activity provide environmental benefits? What are they?
- Does this activity offer equal benefits to all elements of society? What are some?
- Was this activity agreed to through the participation of all people (stakeholders) impacted by the activity?



If the answer to anyone of these questions is NO, then the project or program should be re-designed to address the unsustainable components.

The entire assessment protocol process described above might seem repetitive, but the iterative nature of the process allows one to get completely inside the context of a project and causes one element of the test to build on the previous part(s). Project mapping for example, using information generated from the application of LCA or Ecological Footprint tools, will define the entire scope of the project from a sustainability perspective and when coupled with the questions posed by Gibson (2002) identify the positive and negative impacts of a project, as well as suggest interconnections between different sectors of

influence related to the project. The step of applying TNS tools will highlight the subtle trigger points in our biophysical world that if improperly used by society and economy will prove unsustainable. The sustainability hierarchy assessment process of Marshall and Toffel (2005) will identify from a human perspective any subtle unsustainable characteristics to a project as one moves from the most basic needs of humans to those needs that have to do more with diverse core value concerns. The seven questions of Hodge (2004) serve as a check and balance to the other assessment methods that might be employed. And the consideration of the overlapping circles model will tell us whether all sectors are simultaneously achieving benefits from a proposed program. In this way a set of tools are employed to determine the sustainability capacity of a project or program whose results support the different phases of analysis while reinforcing and further validating the final results of any one part of the testing process. In order to integrate the different testing elements, each phase of "testing" for sustainability might eventually be characterized by a numerical scoring system. Then, the final judgments for a project or program's sustainability could be quantified by an actual number that can be compared to a standard or to the numerical score of similar kinds of projects/programs.

Unlike traditional decision-making, valid assessment for sustainability requires that we consider simultaneously the different sectors of environment, social well-fair, and economy by applying all principles of sustainability at once, seeking mutually supportive benefits. The reasons for this multi-dimensional approach are clear from our awareness that problem-solving in isolation often can lead to unintended consequences for the same sector of concern or for another disregarded sector, further promoting the perils of continued unsustainable behavior (Gibson, et al., 2005). But to-date our situation has been a world of compromises and trade-offs – some of them unavoidable and some probably desirable. What we need is a clear and defensible basis for making well reasoned decisions about what trade-offs, and consequently what proposed undertakings, are acceptable (Parris and Kates, 2003). Application of an iterative sustainability assessment protocol can help to build a transparent, justifiable basis for decisions. But community core values and ethics are part of this process as well. So the testing for sustainability must be done in the context of what has been described previously with regards to processes of citizen science and adaptive management to complement the evaluative picture. Adopting sustainability-based criteria is just another step in appreciating the linkages, in strengthening processes for applying values with a better understanding of context and possibilities, and in looking a little further ahead (Gibson, 2002).

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