Sustainability and the Role of Biodiversity:
The Impact of Anthropogenic Activities

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Abstract

The notion “development” has become again a salient feature in the international realm. In particular Africa is at the forefront of initiatives to reduce poverty. The prescriptions are well known as they focus on economic growth, trade and aid. They have not been very successful in the past, because development took place in a rather hap hazardous and non-sustainable manner. In addition, the limitations imposed by nature on these anthropogenic activities are also often not taken into account.
A different approach is therefore required to address “development” and its impact on biodiversity. To explain the conventional development approach and its impact on biodiversity, several aspects will be examined. Anthropogenic activities have to be regarded as the main cause of non-sustainability. This will be illustrated by arguing that sustainability is a natural phenomenon, whereas the root for non-sustainability is psychological. The failure of the conventional approach to development is the belief that money can buy sustainability. Despite the apparent global consensus on and propagation of sustainable development, the concept has become an oxymoron. It is therefore not an appropriate model for Africa and a new paradigm is required.

Introduction

The Nobel Peace Prize for 2004 to an African environmental activist indicates the realization that the natural environment, and its diversity, is a foremost concern for the global life-support system. The phenomenon “Life” has many different forms and is found in many different environments. Life evolved over billions of years, due to creative natural processes, which have been able to continue despite several catastrophes that changed not only life forms, but also the ecosphere. At present another catastrophe seems to be on the horizon, not as a result of natural processes, but because of the activities of one particular species - humans, or as E.O. Wilson (2002) described it: the planetary killer.

Since the 1960s, when Rachel Carson awakened the industrial world to the dangers of chemicals, several warnings, predictions and “solutions” have been publicized. One influential example is the World Commission on Environment and Development (WCED) or Brundtland Commission. The findings and recommendations of this working group had as a consequence the organization of the Rio Summit in 1992 by the United Nations. In the end Agenda 21 was presented as the guideline towards a “sustainable future”. Despite numerous attempts to change the current way of non-sustainable development, such as the WCED, United Nations Conference on Environment and

Development (UNCED), or the World Summit on Sustainable Development (WSSD), very little has been achieved. Kofi Annan declared before the start of the WSSD in 2002 that:

> … *"progress since then [1992] has been slower than anticipated. The state of the world's environment is still fragile. Conservation measures are far from satisfactory. At discussions on global finance and the economy, the environment is still treated as an unwelcome guest. High-consumption life-styles continue to tax the earth's natural life-support systems. Research and development remains woefully under-funded, and neglects the problems of the poor. Developed countries in particular have not gone far enough in fulfilling the promises they made in Rio – either to protect their own environments or to help the developing world defeat poverty" (Annan, 2002).*

One of the apparently futile attempts is the *Convention On Biological Diversity.* This declaration in 1992 pronounces that the participants are, *inter alia,* "conscious of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components" and "are also conscious of the importance of biological diversity for evolution and for maintaining life sustaining systems of the biosphere" (United Nations, 1992). Furthermore, concern is expressed that biological diversity is being significantly reduced by human activities. This is, however, nothing new. Altenberg (1990) commented:

> *The twentieth anniversary Earth Day of 1990 was a tragic squandering of opportunity, because it told people that saving the Earth meant stopping pollution and preserving wilderness. The two issues of pollution and wilderness will find support from the public as the U.S. is not in an economic crisis. But when the next global economic crisis hits, an emergency mentality will set in, and pollution and wilderness destruction will seem more tolerable if it can bring some immediate economic relief. Earth Day could have inoculated the people with a far more potent idea - that of sustainability - which an economic crisis would only strengthen, because such crises are in fact a part of the unsustainability of this industrial system. Unsustainability is the fundamental problem with civilization as it now operates. We are living in a fool's paradise.*

This fool's paradise has many facets, ranging from socio-economic aspects to psychological factors. One of the outcomes of these conditions is the steady decline in biodiversity and the limited success so far to conserve and preserve natural resources. Nevertheless, rhetoric tries to convene a different message, i.e. the apparent implementation of what is termed sustainable development. However, more and more problems are becoming evident contradicting the claim that the world is moving towards solutions of the current troubles.

Sustainable development and sustainability

Development is usually associated with a positive improvement of a particular situation. However the trends over the last fifty years cannot be regarded as an improvement, if the state of the environment is concerned, otherwise the reports of the Club of Rome, WCED and UNCED would have been

unnecessary. However, the proceedings, such as WSSD and numerous other gatherings, try to advance the impression that everything is not too bad and that sustainable development is progressing well. Are we indeed living in a fool's paradise? To answer the question, several reasons will be elaborated in the next sections. First a summary of current perceptions is provided.

The most widely used definition of sustainable development is based on the first sentence of the Brundtland Commission's definition (1987:43):

> Sustainable development is development that meets the needs of the present without compromising the needs of future generations to meet their own needs. It contains within it two key concepts:
>
> - The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given, and
> - The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

The important aspects mentioned include: future generations, the poor, needs, priorities and limitations of the environment. By emphasizing the world's poor, the attention is shifted away from the negative contributions to non-sustainable development made by the North, such as the global exploitation of resources, which is driven by the money economy, with little concern to the conservation and preservation of natural resources. The concern for future generations are primarily a rhetorical issue, because "we seem mired in a glut of quick, short-term profits for the immediate benefit of a tiny, powerful, linearly thinking, self-centred economic elite" (Maser 1997:113). These political and economic elites are ostensibly concerned with the fate of the poor. However, the fact remains that the needs of the poor today are not met, and the situation is not expected to improve. The elites are unable to change the worsening conditions.

The situation in 2002 was similar to the Rio+5 conference in 1997, where the chair stated that since the five years after Rio, it is apparent that despite the commitments and the accompanying publicity, the basic concept of sustainable development is not yet well understood (Strong, 1997). The concerns of Agenda 21 were during the WSSD in Johannesburg reduced to five issues: water and sanitation, energy, agricultural productivity and food security, biodiversity and ecosystem management, and health (ENN, 2002; Annan, 2002). ENN (2002) comments:

> *All will be wrapped under the rubric of sustainable development - or, roughly, how to manage global economic growth without environmental loss. A decade ago, the leaders also had far-reaching plans. They agreed to treaties to combat climate change and to protect plants and animals, the rich said they would help the poor develop, and they all adopted a huge blueprint to guide themselves through it. But there are few today who would argue that the promises of Rio have been met.*

The failure to achieve a state of sustainability is the consequence of the globally dominating Western ontology. It is found in the definitions of sustainable development where the overlap of economic, socio-political and environmental issues is regarded as epitomizing sustainable development. This condition is hardly achieved in the implementation process. Non-sustainable development continues nearly unabated, as the focus of the ruling elites is on economic growth. In other words, this "development" is part of the problem called non-sustainability, not part of the solution. This position overlooks the fact that biodiversity is the basis of sustainability, i.e. the provision of renewable resources to all living organisms. The steady decline in the number of plant and animal species, habitats and genes, is but one indicator of the damage caused by the global system. Sustainability is not, as Mulder (1999) puts it, "The narrow-minded vision of sustainable development, i.e., sustainable development as developing environmentally sound ways of production and consumption is still dominant in industrialized society". Why is biodiversity so important? Without it, Earth would be similar to the moon or Mars: a lifeless desert.

In this paper six propositions on biodiversity and sustainability are examined to explain how modern development relates to biodiversity and non-sustainability:

1. Anthropogenic activities are the main cause of non-sustainability on Earth
2. Biodiversity and the global resource base is limited
3. Sustainability is a natural phenomenon
4. Non-sustainability is a psychological problem
5. Money cannot buy sustainability, and
6. Sustainable development is an oxymoron.

Biodiversity and sustainability

Anthropogenic activities and biodiversity

Life on Earth started with bacteria. Capra (2002:26) points out that during the first two billion years of biological evolution, bacteria and other micro-organisms were the only life forms on earth. These micro-organisms also support all higher forms of life, as they are responsible for fermentation, nitrogen fixation, or photosynthesis, and created the conditions for Life to exist. This illustrates the authentic meaning of *sustainable*, i.e., from the Latin *subtenir*, 'to hold up' or 'to support from below' (Martin quoted by Department of Energy, no date). Support from below starts at the grassroots level. This necessitates that plant and animal species, habitats and genes, i.e. biodiversity, maintain those levels required to sustain life on earth. If the relative limited size of ecosphere, below and above the ground, deteriorates, the life support systems are jeopardized.

Modern civilization brought with it so-called modern development. This Western styled "development" has created more and more problems. *"Development"* is commonly regarded as involving materialism, consumerism, industrialization, and urbanization. The question has to be asked whether this is "development" or mal-development. Murdoch University (2002) named some of the most proximal effects of mal-development or the *Symptoms of Ecological Unsustainability*:

- Agriculture: Salination, flooding, soil degradation, desertification, fertiliser dependence, acidification, eutrophication, over-production, pesticide dependence
- Manufacturing: CFC and CO_2 production; soil, water and air pollution; toxic waste disposal
- Energy Production: CO_2, acid rain (SO_2), NO_2, N_2O, other airborne pollutants, nuclear threats, waterway pollution
- Mining: CH_4 production, depletion of resources, ecosystem damage (e.g. the *phytophthora cinnamomi* or *jarrah* dieback in *Eucalyptus Marginata*) waterway pollution
- Fisheries: Depletion and local extinction of fish populations, gill netting, marine mammal destruction
- Urban planning: Traffic congestion, air pollution, CO_2, tropospheric ozone, no green belts, pollution of ground water supplies, sewage disposal problems, waste generation, energy requirements, urban sprawl
- Forestry: Dieback, soil erosion, CO_2 production, climate modification.

In Denmark, there is now only little natural forest left and large parts of the forests are quite uniform and often with limited value for biological diversity protection and recreational purposes (Ministry Of The Environment, no date:9). Another example is Japan where no forest has been left and 4,000 of Sweden's lakes that are biologically dead due to pollution (WWF, 1996). Examples in an arid environment such as Namibia have been described earlier (see Wienecke, 2004).

The reason for this steady decline in the number of plant and animal species, habitats and genes, is the absence of a symbiotic relationship between modern humans and Nature. The global promotion of Western style development is increasing global and local problems. Among the reasons are, the decline of renewable and non-renewable resources, in addition to the growth of the human population. "In the popular press, population growth is not often seen as an environmental problem. On a regular basis, we are warned about global warming, ozone depletion, rainforest destruction, groundwater contamination, toxic waste proliferation, shrinking animal habitat, endangered animal species, shrinking petroleum reserves, and a loss of biodiversity" (Smith, no date). The author also argues that all attempts to deal with environmental degradation will fail because they deal with the symptoms of the problem, not the problem itself, i.e., overpopulation. Smith provides one example:

> *Hardin quotes Herodotus, who reported that there had been a time when a person could walk across North Africa from the Atlantic to the Indian Ocean always in the shade of trees. Next, he quotes a tenth century Samanid prince who identified the four earthly paradises as being the regions of Samakand, southern Persia, southern Iraq, and Damascus. Clearly these regions today are known for their sand, not for their similarity to earthly paradises (Smith, no date).*

The unnatural changes taking place over the last millennia are the result of anthropogenic activities and the exponential growth of one species – humans. "There are always limits to growth in nature" (Miller 1996:169). Nowadays the carrying capacity of Earth has been exceeded (see section 2.4),

which has a negative impact on the sustainability of the natural environment. Bartlett (1998:26) notes that if: for whatever reason, humans fail to stop population growth and growth in the rates of consumption of resources, Nature will stop these growths.

1. By contemporary western standards, Nature's method of stopping growth is cruel and inhumane.
2. Glimpses of Nature's method of dealing with populations that have exceeded the carrying capacity of their lands can be seen each night on the television news reports from places where large populations are experiencing starvation and misery".

McNamara predicts that short of thermonuclear war itself, rampant growth is the gravest issue the world faces over the decades ahead. "If we do not act, the problem will be solved by famine, riots, insurrection, and war" (quoted by Miller 1996:247). Another task is the reduction of consumption by the rich countries, whose greed and predatory economy also contributes to the decline of biodiversity.

A population can only continue to grow if resources are available. In the past growing demand in the so-called developing world was satisfied by exploiting external resources. This led to the current unsustainable state of globalization and the disregard for preserving and conservation resources in order to maximize profits. Local self-sufficiency and the reliance on local resources were not longer possible. This expansive and extractive nature of the global economy is one reason for the current state of non-sustainability and mal-development. Jones and Murphree (quoted by Jones, 2003) assert that the most critical decisions regarding the allocation of land, resources and management investments are based primarily on economics rather than conservation considerations. These decisions ignore reality, i.e., there is only one resource base available - Earth.

Earth: the resource base

The activities of the global economy mostly disregard the fact that life on Earth is the outcome of and depends on biodiversity. This makes biodiversity the most important phenomenon with regard to sustainability. It is a holistic system where everything is connected to everything, where an integration of processes and actors into a whole is accomplished in a highly efficient manner. As there is currently only one resource base for all living beings, the limitations imposed by these resources need to be taken into account in all development endeavors. This has two implications for the discussion of sustainability: consumption has to be reduced in the North and the populations in the South have to become much smaller as their consumption of primary resources and pressure on natural resources degrades the environment.

In the past, nature has usually been able to recover from natural disasters (see 2.3). One reason is Nature's ability to be resilient as a result of its cycles, population management, adaptations, and its antipoetic systems. According to Wackernagel et al., sustainability requires living within the regenerative capacity of the biosphere. It is often forgotten that the human economy depends on the

planet's natural capital, which provides all ecological services and natural resources. In order to exist, every species requires space. Six human activities that require biologically productive space include:

(i) Growing crops for food, animal feed, fiber, oil, and rubber;

(ii) Grazing animals for meat, hides, wool, and milk;

(iii) Harvesting timber for wood, fiber, and fuel;

(iv) Marine and freshwater fishing; (v) accommodating infrastructure for housing, transportation, industrial production, and hydro-electric power; and

(v) Burning fossil fuel (Wackernagel et al., 2002). Increasing human populations are destroying the natural environment, so does modernization in the form of industrialization, commercial agriculture and urbanization. Therefore these processes are major contributors to the global state of non-sustainability.

According to Bartlett (1998:6), humans will always be dependent on agriculture. Therefore supermarkets alone are not sufficient and the central task in sustainable agriculture is to preserve agricultural land. The latter must be protected from losses due to:

(i) Urbanization and development;

(ii) Erosion; and

(iii) Poisoning by chemicals.

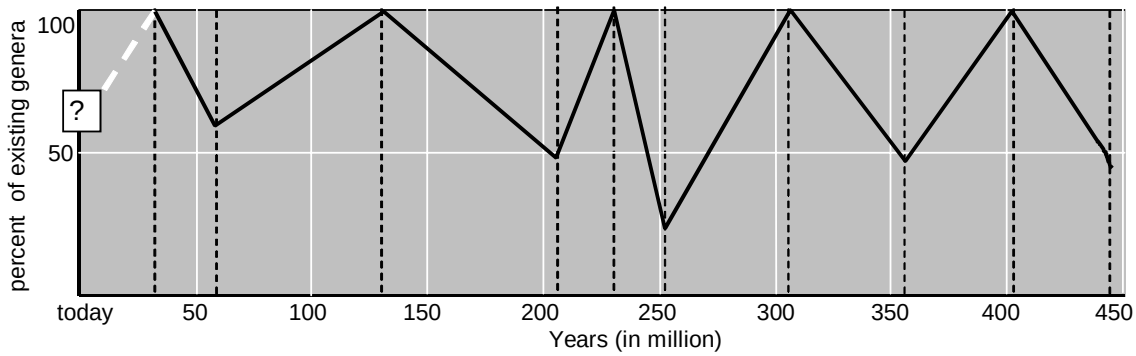
Another factor is that sustainable agriculture cannot be based on large annual energy inputs from fossil fuels, particularly petroleum. "The food system consumes ten times more energy than it provides to society in food energy" (Giampietro & Pimentel quoted by Bartlett 1998:30).

Allison and Hobbs (2004) note that, "natural resource problems are not isolated scientific or technical problems, but are rooted in human failure to understand the links between social, ecological, and economic systems". This failure is illustrated by the decline of biodiversity, climate change, and the inability of humans to imitate natural processes.

Sustainable Nature and biodiversity

Nature has been and is the only sustainable global system on Earth. "Ecological systems are models for sustainability" (MIT 2003:2). The close relationship and interconnection of sustainability and biodiversity can be appreciated, if past catastrophes are considered. According to Erwin (quoted by di Maggio, no date), there have been five major extinctions (so far). The worst catastrophe occurred during the Permian-Triassic period about 251 millions years ago, where about 95 percent of all species disappeared, i.e. 53 % of marine families, 84% of marine genera and 70% of land species such as plants, insects and vertebrates. Based on the only complete set of estimates, i.e. for marine genera, the genera in existence at various periods of time can be schematically represented as oscillations between low points in the number of species and a maximum of 100% over the last 450 million years:

Figure 1 – Extinction of marine genera



The fluctuations present an astonishing quality of Nature: resilience. Nature's resilience, as shown in the graph above, after climate changes occurred due to volcanic eruptions or meteorite impact, indicates that the autopoietic system of Nature cannot easily be damaged. However, the long-term effects of the destructive influences by humans cannot be easily estimated or are not fully understood. Nevertheless, attempts are made to provide a theoretical understanding of resilience.

Redman and Kinzig (2003) explain that, "resilience theory is an expanding body of ideas that attempts to provide explanations for the source and role of change in adaptive systems, particularly the kinds of change that are transforming. Scholars from various disciplines have contributed to the current state of this formulation". According to Holling and Levin (Redman & Kinzig, 2003), this theory seeks to understand the source and role of change in adaptive systems. Change is neither continuous and gradual nor consistently chaotic, although differences exist regarding the speed of change, are they slow or fast, and the size or impact of change, i.e. minor or major. Four phases of the adaptive cycle were identified by Holling (Allison & Hobbs, 2004): exploitation, conservation, release, and reorganization. Each system has numerous sub-systems, which would adapt at different speeds. Furthermore, Nature can fill niches as explained by the autopoietic theory, in order to maintain sustainability and the carrying capacity of the system. To achieve this, an organism requires space for living and also time. In this way a long-term stability is achieved.

These stability factors are now endangered as a result of modernization. "The human economy depends on the planet's natural capital, which provides all ecological services and natural resources" (Wackernagel et al. 2002:9266). In addition to the many other environmental goods and services Earth's biodiversity supplies resilience and other stability factors to ecosystems large and small (Wackernagel et al. 2002:9268). However, the carrying capacity is put at risk by anthropogenic activities and includes modern technologies. "A major use of technology is, and has been, to accommodate the growth of populations, and to remove the recognition of the importance of living within the carrying capacity of the environment" (Bartlett 1998:32). The ecological footprints have illustrated the limitations of the resources available on earth. Biologically productive areas are necessary to continuously provide their resource supplies and absorb their wastes under the

prevailing technology. The available biologically productive area is, however, not a variable quantity but has an upper value, which is the carrying capacity of the earth. In other words, the average per-capita productive land area available for human use is limited and is around 1.7 hectare (Wackernagel, et al. 1997:5).

In order to cover-up the limitations of economic growth, the terms “growth management” and “smart growth” have been invented. Both are used interchangeably to describe urban developments that are functionally and esthetically efficient and pleasing (Bartlett, 1998). Bartlett goes on:

> *Sometimes these planning processes are advocated by those who believe that we can’t stop population growth, therefore we must accomodate [sic] it as best we can. Other times they are advocated by those who are actively advancing population growth. The claim is made that growth management and smart growth ‘will save the environment’. They don’t save the environment. Whether the growth is smart or dumb, the growth destroys the environment. ‘Growth management’ is a favorite term used by planners and politicians. With planning, smart growth will destroy the environment, but it will do it in a sensitive way. It’s like buying a ticket on the Titanic. You can be smart and go first class, or you can be dumb and go steerage. In both cases, the result is the same. But given the choice, most people would go first class.*

The connectiveness and interdependence of the numerous parts and wholes of Nature provide for the long-term existence of all organisms and their adaptations. This process is not static, but dynamic, as Nature’s creativity can fill niches and new species can be created by adapting to new conditions. It is a win-win situation for life. This presents the opposite of the anthropogenic position, which is illustrated in the narrowly defined notion of progress and development as part of the modernization process, which benefits only one selected species.

Modernization and globalization

The spread of modernization around the globe is often referred to as “development”. A distinction is made between developed and developing countries, with the goal that the latter requires more “development”. This has been criticized in the past with little effect. Even international occurrences such as the Brundtland Commission or Agenda 21 have not succeeded to provide a basis for moving away from the non-sustainable way of modernization. “Development” took place in convenient locations where resources and production facilities were available for far away markets. The impact on the local biodiversity has been disregarded in most cases. Furthermore, a non-holistic approach prevailed, which focused on profit maximization and not sustainability. Therefore this type of development is a haphazard process with the consequences that, for example, forests in Kenya and Cameroon are declining, urban sprawl and pollution is increasing. This is destruction in the name of “progress”. The absurdity of “modernization” can be illustrated as follows: if each person currently alive would attain the US level of consumption, it would require four more Earths (Wilson 2002:150), or three planets to attain the standard of Great Britain (BBC TV “Earth Report”, broadcasted 31 July 2002).

One reason for the non-sustainability of Western type developments is the linear nature of consumption. The consumption model follows the pattern of material input, utilization and waste at the end of the process. This constellation requires unlimited resources to feed the system and system and unlimited space to deposit wastes and used products leaving it (Allenby quoted by Fleig 2001:7). The resources include those occurring on Earth and the energy coming from the sun.

Cyclical loops help to explain why the current nature of industrialization and globalization is not sustainable. For a system to become sustainable, a dynamic equilibrium of ecological systems is required, where energy, resources and wastes are constantly recycled and reused by other organisms and processes within the system. “This is a highly integrated, closed system” (Garner & Keoleian quoted by Fleig 2001:7). If this system is applied to closed industrial systems, only solar energy would come from outside, while all by-products would be constantly reused and recycled within (Garner & Keoleian quoted by Fleig 2001:7). This represents a sustainable state and is an ideal goal of industrial ecology. Fleig points out, that a closed cyclical loop system is not achievable at the level of eco-industrial parks, because fabricated products do have to leave such a park, thereby diminishing the amount of materials circulating within the system. Therefore new material inputs are required constantly. Although reuse or recycling could assist in this endeavor, it could increase the costs of such a system to an extent that it becomes too expensive. In other words, money determines whether the system is sustainable or not. This could be called a pseudo solution. Bartlett notes (1988:16) that:

> *From the highest political and planning circles come various suggestions that are intended to address the problems caused by growth and thus to improve the quality of life. Many of these suggestions are ‘pseudo solutions’ to the problems. At first glance, these sophistic solutions seem logical. A moment’s thought will show that, in fact, they are false*.

Wackernagel et al. (2002:9267) have noted several “solutions” to accommodate human demands, but not the requirements for sustainability:

1. Growing crops requires the most productive land of all;
2. Grazing animals requires pasture;
3. Harvesting timber requires natural forests or plantations;
4. Fishing requires productive fishing grounds;
5. Accommodating infrastructure for housing, transportation, industry, and hydroelectric power results in built-up land; and
6. Burning fossil fuel adds CO_2 to the atmosphere.

Wackernagel and his collaborators have calculated (2002: 9268) that human activities have exceeded the biosphere’s capacity since the 1980s. This overshoot is explained by the authors as the extent to which human area demand exceeds nature’s supply: “whereas humanity’s load corresponded to 70% of the biosphere’s capacity in 1961, this percentage grew to 120% by

1999. In other words, 20% overshoot means that it would require 1.2 earths, or one earth for 1.2 years, to regenerate what humanity used in 1999".

The narrow-minded promotion globalization at the beginning of the 21st century is placing additional demands on the availability of resources. There are no human checks and balances in place to control exploitation, unlike in nature. Bartlett notes (1998:31) that the food chain is nature's equilibrium mechanism as it functions to prevent unlimited expansion of populations of flora and fauna. "Primitive human societies[1] were able to maintain approximately constant populations and to live within the carrying capacity of their ecosystems. The methods they used to maintain approximately constant populations were often cruel and inhumane. Technology has given many people the feeling that, through our own efforts, we are exempt from the cruel constraints of limited carrying capacities". Bartlett goes on (1998:22): "Societies, or sectors of a society, that depend on population growth or growth in their rates of consumption of resources, are unsustainable". Elisabet Sahtouris (1995) describes an alternative:

Sarah James, a Gwich'in Indian from the northernmost inhabited village in Alaska made the trip to Rio de Janeiro for the Earth Summit in 1992. She described her caribou culture before contact with the white man as rich – rich with family, warm homes and clothing, plentiful food, much time for ceremony, music, dance and story telling, much reason for celebration. When the white man came to them, he saw only people living in 40 degrees below zero weather, with only caribou to provide food, clothing and skin huts. He called them 'savages'. …Such a life style was truly rewarding as long as its natural simplicity was an integral part of a spiritually rich culture.

The University of California (2002) has pointed out four consequences of the theoretical dichotomy between economy and ecology:

1. Economics represents the economy as separate from the environment. By contrast the ecological perspective sees the human economy as an inextricably integrated, completely contained, and wholly dependent sub-set of the ecosphere.
2. Economic theory treats capital and individual inputs to production as inherently productive, ignoring both their physical connectedness to the ecosphere and the functional properties of exploited ecosystems. By contrast, ecology is a science of connectivity, preoccupied with material and energy flows and their relationships to the functional integrity of ecosystems.
3. Neoclassical theory - resource depletion is not a fundamental problem thanks to pricing mechanisms that forces substitution and conservation. By contrast, ecology argues that humankind remains in a state of obligate dependency on numerous biophysical goods, and services which are not accounted for by market forces (e.g., ozone).

[1] The term "primitive" has to be rejected as traditional societies have or had rich cultures, highly developed local knowledge and skills.

4. Mechanical metaphor of economy as a perpetual motion machine with the circular flow of exchange value as its self-generated fuel - contrasts to the ecological emphasis on entopic throughput.

The current destruction of the natural environment and interference in Nature consists of unnatural processes. This development affects biodiversity, conservation and the preservation of natural resources negatively. Development as part of modernization and globalization creates habitat fragmentation, possible interruptions of evolutionary processes, and extinctions. “Extinction is forever” (Bartlett 1998:27).

Modernization and globalization advocates have not yet been too concerned about the effects of biodiversity deterioration, with a few exceptions. The establishment proceeds with its motive of creating wealth for a minority. The World Summit on Sustainable Development showed that the targets of 1992 were wishful thinking on the one hand and on the other hand illustrated the lack of commitment and interest in implementing sustainable development. The Asian Coalition for Housing Rights’ newsletter (February 2002) argues:

> *Despite all the inspiring rhetoric you hear about participation, decentralization and community control, the hard facts of most development interventions reveal an iron grip on project-design, process and – most importantly – MONEY. Even more disheartening is the scandalous inefficiency of the prevailing mechanisms, which deliver aid intended to benefit the poor.*

In other words, whenever money is involved, sustainability flies out of the window. Anthropocentric “development” is at the core of the non-sustainability problem. The reason for this is the psychological dimension of “development”. It is one aspect, which is hardly dealt with in the deliberations surrounding sustainable development and biodiversity.

Biodiversity and the psychological limitation

The deterioration of the ecosphere is the result of anthropogenic activities. Therefore one has to ask: can humans manage NATURE and therefore biodiversity? To answer the question, the answer has to consider the source of non-sustainability: the human brain. The most limiting factor in achieving sustainability is the human mind. It is the core problem as this involves attitudes, ethics, values and beliefs. According to Peet (1992), Western culture was shaped by interpretations of the Bible, particularly the early books of the Old Testament, and pictured humans as separate from all other creatures and dominating them. Many still feel what is almost a divine imperative to "master" nature. It stems from a linear, hierarchical, authoritarian world view in which God is above, nature is below, and man is in between, set above everything but God (not forgetting that woman is set hierarchically below man).

The biased Western ontology provides a fragmented view of reality by not considering the holistic whole. Instead only one or a few parts are considered or taken into account. Smuts (1927:249) explained that the individualistic aspect of Holism in its higher developments, which evolved over time from physical and chemical affinities and selectivities to the state when an individual begins to direct his course according to conscious voluntary purposes. “The individual makes his own plans and no longer automatically follows Nature’s plan” (Smuts 1927:249). He further states that, “desired things become the Values, which intelligence illuminates and magnifies and emotions suffuse and intensify until they become the dominant Ideals of action. We see the rise of not only of new mental activities but of new categories such as Purpose and Value, which were not possible or necessary on the organic level” (Smuts 1927:250). Over time, humans have moved away from the basis of relying on what Nature produces and by following natural cycles. This has been complicated by the capacity of the human brain, which can *inter alia* produce abstract concepts and illusions.

> *Humans are the only animals known to self-deceive. There is no evidence to suggest that any other species besides our own possesses this capability. At a conference of the American Association for the Advancement of Sciences in 1991, Washington University anthropologist Robert Sussman said, 'Self-deception is what separates us qualitatively from all other animals and even early hominids.* (Dean quoted by Hanson, 1997b).

Hanson (1997b) concludes: “Indeed, self-deception and exploitation certainly seem to be what we do best”. The belief in human abilities and the disregard for other forms of life and the importance of biodiversity, is presented by the following quote by Samuelson (in Newsweek 7 April 2003:54):

> *We Americans want it all: endless and secure energy supplies; low prices; no pollution; less global warming; no new power plants (or oil and gas drilling, either) near people or pristine places. This is a wonderful wish list, whose only shortcoming is the minor inconvenience of massive inconsistency.*

Change is therefore of importance, which should be achieved through learning. “Learning has been defined as a relatively permanent change in behaviour that occurs as a result of experience” (Goldstein, Mwanwenda, Hilgard & Bower quoted by Mkize 2003:119). However, the history of humans is characterized by the fact that humans have not learned from their history. If learning from experiences had occurred over the last decades, the steady decline in the number of plant and animal species, habitats and genes, would have resulted in a drastic change of behavior. This has not been forthcoming despite the fact that new approaches have been formulated, for example, deep ecology.

Professor Arne Naess introduced the term deep ecology to describe the mission of ecophilosophy’s exploration into the diversity of perspectives on human-Nature contexts and interrelationships, to foster deeper and more harmonious relationships between place, self, community and the natural world. The word "deep" in part referred to the level of questioning of our purposes and values, when arguing in environmental conflicts. The "deep" movement involves deep questioning, right down to fundamentals (Drengson, 1999). Deep ecology is regarded as a holistic worldview, emphasizing the

whole rather than the part (Capra 1995:20). One common trait in the discussions surrounding deep ecology is the questioning of the relationship between human communities and nature. As Berry (1995:9) puts it: "[t]hese questions ultimately arise because at the present time the human community has such an exaggerated, even pathological, fixation on its own comfort and convenience that it is willing to exhaust any and all of the earth's resources to satisfy its own cravings. The sense of reality and of value is strictly directed toward the indulgences of a consumer economy". The views expressed are mainly trying to explain the current situation in Western industrialized countries.

Non-conventional approaches could be described as creative. Creativity is the ability to create original, novel, personally or socially ideas (Jackson & Messick, Jones, Mumford & Gustafson quoted by Eaton, Luiz, Schwellnus & de Klerk 2003:311). A creative thought process could be described as constituting divergent production. The latter is "the ability to escape the confines of rational logic and find many alternatives, novel or unexpected ideas as solutions to problems" (Eaton, Luiz, Schwellnus & de Klerk 2003:311). However, the far-reaching changes required to achieve sustainability are evaded by modern humans. They protect the status quo by reinforcing the humanistic agenda. This anthropocentric position is reflected in Principle 1 of the Rio Declaration: "Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature" (UNCED, 1992). Sustainability necessitates a healthy and productive life of all the other organisms too, because a holistic system includes all living organisms and inorganic matter.

What is sustainable development?

The emphasis on environmental issues and the claim "of living in harmony with nature" in the discussion about sustainable development is usually related to the poor or "developing" parts of the world. What about the rich? The environmental agenda is an agenda created by the North, the rich, industrialized world. The economic and political mindsets of the proponents of the North are the main causes when it comes to global environmental degradation. The North pollutes and consumes too many resources, reduces biodiversity on a global scale, and the technologies and the associated ideology is exported to the South, where the impression is gained that the North holds the one and only solution to the world's problems. However, Kamal (quoted by UN-Habitat, 2004) argues:

> *In a world where man exploits man, nature is also exploited. We are to blame for our failure to establish a rational, ordered and logical way of living. Nature has no capacity to defend itself against man, and both nature and humanity are now fighting for survival. Both may perish together and we are not even conscious of the risk.*

Engels (quoted by Turan 1983:143) wrote in the nineteenths century: "when abused nature takes its revenge on us". This contradicts Kemal's statement, that nature is defenseless. Some of the warning signs are already known. Nath (2001:2-3) points out: "As the impact of environment degradation started to be felt by the civil society in the west through pesticides in food products, pollution of local streams and increase in cases of skin cancer, it lead to an awareness that "environment matters" and

“its is a limited resource”. Nevertheless, change of the status quo is slow and limited by established interests. Attempts to relate sustainable development to a state of sustainability have so far failed. Humans are not able to replicate Nature’s ability to maintain a holistic whole.

There are many examples of degraded or damaged ecologies. Most cannot be restored. Two examples may suffice. Rainforests and arid areas are highly sensitive ecosystems. In the first case, a huge variety of living organisms are found, whereas in the second case, a very limited number of species can exist. Despite this contrast, damage as a result of anthropocentric activities to either one can lead to extinctions or permanent damage. Humans are able to destroy, but not to create a sustainable system. Recent research has indicated that anthropogenic activities could have changed the global climate during the last 8,000 years and not only since the industrial revolution. Concentrations of CO_2 entered the atmosphere when humans started clearing forests and irrigated fields to grow crops (Ruddiman 2005:36). In the last 2,000 years Europe, India, Southeast Asia and China have cleared much of their natural forests in order to grow crops such as wheat and rice (Ruddiman 2005:39).

What is internationally regarded as sustainable development, or the promotion thereof, is based on agendas, such as Agenda 21. Here an attempt was made to find a solution to global problems created by humans. It contains aspects such as reducing poverty, air pollution, diminishing forests, and biodiversity issues. The topics included in Agenda 21 are a summary of crises and how they should be tackled in the name of sustainable development. In other words, sustainable development is a merely a catchphrase for the real issue: crisis management. Crisis management can never lead to a state of sustainability.

> *... [c]risis management is concerned on the one hand with the procedure for controlling and regulating a crisis so that it does not get out of hand (either through miscalculations and mistakes by the participants or because events take on a logic and momentum of their own) …, and on the other with ensuring that the crisis is resolved on a satisfactory basis in which the vital interests of the state are secured and protected* (Williams quoted by East Asian Review, 2003).

Sustainable development has been included in the international political agenda to protect the *status quo* of the dominant establishments in politics and business. “The time horizon of political leaders is of the order of two to eight years”, and “It will be difficult to convince political leaders to act now to change course, when the full results of the change may not become apparent in the lifetimes of those leaders” (Bartlett 1998:23). Therefore the term “sustainable development” provided by the Brundtland Commission has been misappropriated by the business and political elites. They are driving the agenda of international summits. Therefore the term has become an oxymoron. As the representative of the worst polluter put it: "If this looks like Kyoto, the answer is no. The Kyoto treaty would have wrecked our economy" (BBC News, July 4, 2005). As Simpson put it: “The trouble is, self-interest is

always the dominant force at these summits: like it or not, that is the way of the world" (Simpson, 2005).

Sustainable development has to be regarded as an oxymoron, which camouflages the real problem of a non-sustainable way of life. Orson Wells has created a term, which describes this contradictory position - doublespeak. Examples are defeat is victory, lies are truth, war is peace, freedom is slavery and ignorance is strength. This fits in the dominant paradigm promoted by the North where non-sustainable development is sustainable development. The continuing deforestation and increases in CO_2 emissions, are contributing to a reduction of biodiversity. Although Nature has shown resilience, Nature needs time to adapt. Anthropogenic actions could prevent this from happening. Therefore attempts to conserve and protect natural resources would become a futile exercise.

Conservation and preservation of natural resources

To avoid a crisis in the case of biodiversity, efforts are made to conserve or protect a particular habitat. These areas are usually focusing on a limited geographical part or islands, which is isolated from the immediate surroundings. Often species are introduced to promote tourism, i.e. generate an income to maintain efforts of conservation. Among the examples are elephants in southern African parks and conservancies, where the populations have increased until they reach unsustainable proportions with regard to the natural carrying capacity. This affects the natural environment within the protected area. Human interference in natural control processes produces overpopulation. To remedy this situation, methods are then applied, which are not applicable to human overpopulation - they shoot elephants, don't they?

Stuart-Hill (2003) points out that a number of economic studies have shown that wildlife is a superior form of land use in more arid areas. Changing the economic system of poor communities, for example from goat farming to wildlife, is an arduous endeavor. Stuart-Hill (2003) states that effective natural resource management is dependent on: a) the ability of communities to directly benefit from resources; b) minimum interference in sustainable utilization; c) communities having legal and physical means of controlling access to resources; d) cohesive community institutions; and e) a stable socio-political system within the country.

> *Sustainable development underpins CBNRM Community Based Natural Resources Management]. But is development sustainable? An answer to this question would probably emerge from answers to the following (normally unasked) questions. What is the human population limit? What is the developmental endpoint? Is the environment physically capable of delivering this target without ecosystem rundown? If not, what parts of the ecosystem will be written off? Is it really possible to run a multitude of different land uses in the same area? Presently we turn a blind eye to this concern and make leaps of faith in CBNRM. Sustainable development may be a rather utopian concept* (Stuart-Hill, 2003).

The benefits of large efforts to preserve the environment are easily canceled by the added demands on the environment that result from small increases in human population (Bartlett 1998:25). The exponential increase of one species can ruin the basis of existence of other organisms. Nath (2001:17) points out that:

> *It is an irony, that one of the most valuable resource - environment - essential for human survival continues to be exploited and appropriated by the west even beyond their national borders. Allowing over-consumption and non-payment of environmental debts has become a rigid element of their policies.*

The dynamics of nature and society relationships differ between modern and traditional society. Among the circumstances and processes, which maintained a positive ecosystem-social system, were community concerns, commitments, incentives and facilities to protect and regulate the use of natural resources (Jodha 1998:299). In addition community capacities were enhanced to respond appropriately to biophysical circumstances through a combination of productive and protective measures. Rules were enforced to help in the adapting needs to resources rather than manipulating and overextracting them to meet unrestrained demands. Jodha (1998:299) summarizes three elements, which strengthened the ecosystem-social system links and thereby contributing to a natural resource-friendly traditional management system:

(a) A total dependence-driven stake in the protection of natural resources;
(b) Close proximity and a functional knowledge-driven approach to resource use; and
(c) Local control-determined sanctions and facilities governing resources use. Also, the smaller populations and greater social cohesiveness of traditional societies were the major facilitators of the above responses".

Knowledge about Nature and the intricate relationships between the many parts and wholes is still limited, although humans claim to have vast knowledge. Little knowledge can be dangerous. Earth is a highly complex ecosystem, which is hardly understood by humans. To continue with unsustainable practices is endangering the basis of Life on earth. However, in Africa, the non-sustainable model of the North is promoted as the solution to the many problems. High population growth rates on a continent where a substantial percentage of the land consists of deserts and arid regions, the question of conserving and preserving natural resources is becoming critical.

The African situation

In the run-up to WSSD in South Africa, the UN Secretary General issued a statement in which he proposed five targets the international community should address. This is an indication that the idea of sustainable development provided by UNCED has failed. By focusing on only five targets, sustainability is impossible to achieve, as this does not comprise a holistic approach. Agenda 21 has not been able to become a guide for a sustainable future.

According to Middleton and O'Keefe (1995:40), the Brundtland report has mediated the discussion of poverty through environmental problems, by reducing, what capitalist powers saw as a political and economic threat posed by confronting poverty directly, "to a less easily defined and apparent less contentious field". The authors go on by stating that "This was not enough, the US and its allies set about the complete emasculation of the Conference's agenda, almost wrecking it in advance. Those powerful men had woken up to the dangers of environmentalism and set about neutralizing it" (Middleton & O'Keefe 1995:40). This provided a powerful basis for the promotion of the Western ontology and eliminated the need for a new agenda. The geographical South is following the model of the North of a global transition towards non-sustainability, instead of embarking upon on an own model. Not much creativity has been demonstrated, i.e. no alternatives to the dominant model of the North have been presented so far.

Dialo Diop reasons that Africa is said to be under threat of marginalization within the global market and even the recolonialization by the new masters of a changing world, "which is subjected to the cult of private property and monetary profit, a world so Darwinian it fringes on inhumanity" (Diop 1999:3). Frantz Fanon (quoted by Magubane 1999:35) asserted: "Europe is literally the creation of the Third world. The wealth which smothers her is that which was stolen from the underdeveloped peoples".

An attempt was made to change the above situation by formulating the New Partnership for Africa's Development (NEPAD). It was hailed as a solution by its protagonists. The NEPAD document states that unless something new and radical is done, Africa will not achieve the international development goals and the seven percent annual GDP growth (quoted by Diescho 2002:1). Diescho (2002:52) also states: "For Africans to believe that they are doing something different by singing the same song that was written for them by others, then raise the bowl for donations, is not what the New Africa needs". What is needed is creativity (as defined above) to produce an appropriate solution in line with divergent production, i.e. appropriate solutions, not poor copies of northern greed, biodiversity destruction, and the colonialization of the minds in the South. Albert Einstein advised that "[t]he significant problems we face cannot be solved at the same level of thinking we were at when we created them" (Einstein quoted by UBS Warburg. 2003:6). Are there other alternatives?

Africa has still some societies and/or communities displaying principles of a symbiosis between humans and Nature. These groups are often described as traditional. Those who still display a non-destructive relationship with Nature could serve as an alternative model. These societies have been in existence much longer than the "modern" societies, i.e. thousands of years versus about 200 years. Those ancient communities who lived beyond the means of the natural environment have vanished. Some examples in the Americas are described by Diamond (2000).

Africans did not anticipate changes in the future of their communities (Omari 1990:170). Forests and shrubs of their worshipping places were preserved for both present and future generations. The destruction of holy places would make the ancestors angry and misfortune might befall the

community. Future generations would face misfortunes if resources, God has entrusted to them, were misused or destroyed. Positive values towards the use of natural resources were inculcated from generation to generation by means of proverbs, stories, songs, and religious ceremonies or rituals, e.g. rainmaking, which strengthened natural resource values.

This was also the case in Northern Namibia, where as part of the promotion of socio-economic advancement, the Kunene Region has experienced an influx of tourists, interested in the arid landscape and its people (the Ovahimba). Improved access by road has resulted in the large influx of outsiders. Many of the indigenous people have been exposed to other external influences, such as missionaries trying to convert them to Christianity and to provide them with Western education. The question is, do they really need this or are they now being brainwashed by outsiders? Many writers have pointed out that the Western way of life should not be copied in the South. Therefore one can conclude, that this would have adverse effects on traditional sustainable societies and the natural environment on which they depend.

The Kunene Regions, as well as other arid ecosystems in Africa, have been the home of nomadic populations, whether pastoralists or hunter-gatherer, “because production systems have had to adapt to an especially harsh and unpredictable environment” (Niamir-Fuller 1998:257). Low net primary productivity and high variability in ecosystem structure and productivity characterize these systems. Nevertheless these arid areas are characterized by ecological variability, unpredictability and high resilience. As a result they never achieve a equilibrium due to the unstable climate. Therefore the arid ecosystems change from one level or state to another. Niamir-Fuller (1998:258-259) notes that even if the landscape looks bleak one year, it will spring back to its full productivity as long as ecosystems resilience has not been damaged. One may add that the local cultural system also should not be damaged as it contains the necessary indigenous knowledge.

In the case of the Ovahimba, there are many efforts underway, aimed at changing the traditional “primitive” way of life and turning it into a modern lifestyle. The Khoi and San are examples of the disastrous outcome of becoming “modernized”. Many have succumbed to alcoholism and the accompanying social and health pathologies. This exposure to Western influences cannot contribute to sustainable development, including sustainable tourism. However, the Indigenous People’s' Plans of Implementation on Sustainable Development states (Tebtebba, 2002):

> *We will take responsibility for tourism activities we generate, that these are based on our own development strategies, incorporate the respect for our traditional values, ethics and human rights and conserve our natural and cultural heritage.*

Achieving “sustainable development” is the current international consensus. However, this objective is ridiculous, if the existing sustainable societies are becoming extinct by changing them into modern 21st century societies. Then as part of modern sustainable development, they have to become “sustainable” again.

What can be learned from these functional traditional societies? A simple and natural life style is sustainable, i.e. the opposite of what is promoted by the West and its allies. The global spread of western ideas and principles creates a global environment for non-sustainability, whose influence has in the last centuries also destroyed cultures. By adopting a foreign culture, Africa is loosing its identity. The adoption of a foreign culture is like a franchise, it can be used, but it is never part of one's own culture.

The holistic way of life of many traditional African societies have, before coming into contact with the West, provided a holistic, and very close to sustainable, way of life. This is illustrated in the multitude of different cultures, each one appropriate to a certain environment and circumstances, from rain forests to deserts. They reflect what is found in the natural environment – a wide diversity and well suited to the conditions of a particular locality. Loosing such a culture has resulted in the many problems the societies of the modern world are experiencing, e.g. poverty or environmental degradation. These problems are also indicative of the non-sustainable way promoted by the North. A dysfunctional model cannot become sustainable. Nature's ability to change and be creative has so far not been emulated by humans. They are therefore the weakest link in the sustainability paradigm.

Conclusion

The steady decline in the number of plant and animal species, habitats and genes, is the result of many factors: overpopulation of one particular species, the egoistic nature of humans, psychological factors, and short-term gain for the ruling elites. Any attempt to achieve a state of sustainability will fail if the psychological barriers for change remain untouched. In addition a holistic ontology is needed to guide the way forward, because the current dysfunctional political and economic system of the North has been proven to be not sustainable. Kotze and Kotze (1993:15) suggest that holism as an ontology is needed to deal with the global problems facing the world in the twenty-first century.

Sustainability can only take place locally on condition that resources are not exported or removed, as is the case with industrialization and globalization. In this way local sustainability, as one part of the whole, contributes to the global sustainability. Moving resources around, contributes to dysfunctional and distorted local and global ecologies. The holistic theory states that the sum of the parts is greater than the whole. If parts in a holistic system become degraded over time, the whole system is slowly deteriorating.

Solving the non-sustainability problem and thereby maintaining global biodiversity, requires a paradigm shift of major proportions, especially in the psychological realm. Existing "sustainable" societies need to be studied to create a new model. Furthermore, ecology shows that it is impossible to have one dominating species. Diversity in biology, but also in the case of human culture, is of utmost importance. There is not one formula for solving all problems. Unless the dominant views are

revised to promote a move away from non-sustainable behavior, “sustainable development” will remain an oxymoron, and an oxymoron can neither be implemented, nor envisaged.

To borrow Claude Smadja’s statement[2] and apply it to sustainability, the following can be concluded with regard to the supposedly solution, or medicine to the world’s problems, called sustainable development: (a) the prescription is wrong, as it is based on the unsustainable model of the West, (b) the proponents of the West are incompetent as the conditions in the South are very different to those in the North and different solutions are required, which the West does not have, and (c) the North is fooling the South (see G8 summit in July 2005 – the agricultural subsidies paid, unfair trade practices, or the debt burden). It is this hypocrisy and the application of double standards that have created the non-sustainable conditions mentioned, but also the issues surrounding the loss of biodiversity.

Therefore a transformation from the current state of non-sustainability towards a state of sustainability is needed. This requires a change of attitudes, the promotion of a simple lifestyle and not a system based on a predatory economy, dematerialization, and a solution to the problem of overpopulation and the resultant lack of productive space. However, Machiavelli wrote in *The Prince*: “And it ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. Because the innovator has for enemies all those who have done well under the old conditions, and lukewarm defenders in those who may do well under the new” (University of Adelaide Library, 2003).

Self-reliance and sufficiency are needed in addition to space in order to provide a basis for life of all organisms. Unsustainability will be the certain result of any program of “development”, which does not focus on the achievement of zero (or a period of negative) growth of populations and of rates of consumption of resources. This is true even if the program is said to be “sustainable” (Bartlett 1998:22). A link between ecological systems and human society has to be established to avoid the future degradation of the basis for Life.

The main problem of the modern world is the psychological dimension, which has been a latecomer in the evolution process and does not feature much in the debates surrounding sustainability. The main reason for the continuing deterioration of the environment is the outcome of the haphazard development that is guided by the psyche of humans, which pays little attention to conservation and preservation of natural resources. In other words, the egoistic nature of humans, as reflected in the anthropocentric position of the advocates of Western style “development”, is focusing on short-term results not a future teleological position. The latter should be the achievement of sustainability. Sustainability is a long-term phenomenon. The current situation has been summarized by Szent-

[2] The promotion of the ever-closer union of Europe, the process of integration, was said to be the best medicine. But “instead you get sicker and sicker, with unemployment and anxiety growing, you have to conclude at some stage that (a) the prescription is wrong, (b) the doctor is incompetent or (c) that he’s fooling you” (Smadja 2005:17).

Györgi (quoted by Fiedler et al. 1992:1): “This is an age of much knowledge, little wisdom and even less ethics”.

Nature is a metaphor for sustainability. It is the only functioning holistic system in existence. Humans are not able to imitate this system. Only those human communities, which have a symbiotic relationship between nature and the needs of particular communities, can be regarded as sustainable. Those who have in the past over-exploited the available natural resources have vanished. At present no one knows how resilient Nature is. If the continuous onslaught on the autopoietic systems of nature continues, it will collapse sooner rather then later. Only an ecological driven natural resource system, and not an economic driven system, can endure. The experiences of the Easter Island or Chaco Canyon should serve as practical examples and warnings. Diamond (2000:5) describes the nature of humans when a collapse approaches, for example, in the case of the Easter Island: “three-quarters of the human population did die out in an orgy of cannibalism, starvation, and warfare”.

Modern humans have, in historic terms, appeared only recently, but have managed to become the most destructive species on earth, as their anthropocentric activities are not autopoietic. The effects of non-sustainable development on biodiversity are similar to Rachel Carson description of the after effects of chemical poisoning: “No witchcraft, no enemy action had silenced the rebirth of new life in this stricken world. The people had done it themselves” (quoted by Rachel Carson Institute, no date).

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