INTRODUCTION

THE CHALLENGE OF SUSTAINABILITY

Over the course of this century, the relationship between the human world and the planet that sustains it has undergone a profound change. (WCED, 1987, p. 22)

THE LIMITS TO GROWTH

Over the past two centuries, through increases in numbers and use of technology, humans have become the de facto managers of the planet. Human demands and the processes put in place to satisfy them have caused stresses affecting the overall functioning of the global ecosphere. Each of these actions has the potential for repercussions that can affect the capacity of the ecosphere to continue to support global and local life-support systems. The result is that all decisions are, in effect, environmental decisions, and managers are increasingly being challenged to incorporate responsibility for impacts into their decision-making processes. But while our ability to bring changes to the planet has grown at a great rate, our capacity to manage the impacts of these changes has not kept pace.

The concept of sustainability and, indeed, the term “sustainable development” have been in use since at least the early 1970s. If nothing else, the term — intensely discussed, examined, and dissected — has served to catalyze the debate over the relationships between economic progress and the natural resource base in which it is grounded (Redclift, 1987). In attempting to make the transition from concept to paradigm to practical application, we should examine the concept of sustainability and the evolution of its expression in the international forum.

The roots of the concept of sustainability are deep — founded in the traditional synergy between humans and the rest of the environment, which permitted the development of the civilizations of the planet. Before the discovery or invention of industrial technologies, the relationship was immediate and clear to all: Violate a natural limit and you or your village perished. This relationship was underlined by the work of Malthus (1766-1834), who postulated a catastrophic end to the civilization of Europe through plague, pestilence, and war, as a consequence of the violation of natural limits. But the advent of new technologies, the discovery of new energy sources, and the invention of more effective means of resource extraction and transportation seemed to disprove Malthus, as industrially powered growth brought wealth to many. In fact, during the 19th and 20th centuries, growth began to be seen as the primary goal of societies — synonymous with improvement, and worthy in its own right. After all, the potential of the planet was considered to be infinite, and exponential growth was seen as the driver of progress.

But while the limits to growth were redefined by technology, they were not eliminated. Through applications of some of
the same technologies that promoted industrial growth, the global scale impacts of human activity became increasingly apparent. The first satellite images showed the Earth as a fragile, unified sphere. Remote sensing began to reveal the widespread effects of pollution, desertification, and coastal degradation. Advances in communications technology provided instant knowledge of the cumulative effects of human impacts, even if those affected were on the other side of the globe. The wastes and by-products of human technology were detected even in the areas most remote from settlement — the Antarctic, the mid-Pacific, groundwater systems, the upper atmosphere. Environmental problems that managers initially viewed as local phenomena began to be seen as parts of an overall pattern of cumulative stresses on the planetary life-support system.

From this new global perspective, we gained an appreciation of the cumulative effects of stress on a planetary scale. It became clear that such phenomena as desertification, soil degradation, habitat destruction, loss of biodiversity, toxification of water sources, and stratospheric ozone depletion were manifestations of these cumulative stresses. The complex interconnections between human enterprises and the ecosystems of the planet also became clearer. An individual property or management unit was not an isolated entity, but part of a larger pattern of human-planet relationships. Global telecommunications also helped us to understand that the world has, in effect, become smaller relative to the magnitude of our endeavors. We know that it is no longer viable to try to manage individual localities or enterprises in isolation, focusing only on the immediate or personal. Our management decisions affect not only our own interests, but those of others, often miles or even continents away. Events far away also contribute to cumulative effects that endanger our own individual enterprises and lifestyles, as well as our shared life-support systems.

By the mid 1960s, some people were beginning to realize that the limits perceived by Malthus still existed. While advances in some technologies had postponed the day of reckoning, others apparently had acted to increase the pace and severity of degradation. In 1972, the Club of Rome brought into focus the "Limits to Growth," identifying trends that — if not changed — would lead to unacceptable outcomes for the human residents of the planet and for many other species (Meadows et al., 1972). Also in 1972, the United Nations Conference on the Human Environment (Stockholm) catapulted environmental issues onto the front pages and began a period of transition that saw the establishment of ministries of the environment in a majority of the world's nations. The Conference initiated an ongoing dialogue, which has often set managers against environmentalists in a pro-growth/anti-growth confrontation. While many restrictions on pollution or certain forms of development were put in place by national or local jurisdictions, the process remained essentially regulatory and confrontational.

CONSERVATION AND DEVELOPMENT

In 1980, a new global initiative was launched, based on the concept that conservation of the environment should be fundamental to management and planning. The World Conservation Strategy (WCS) of the International Union for the Conservation of Nature and Natural Resources (IUCN/UNEP/WWF, 1980) was conceived as a document that would support holistic (environmental) planning at national and regional scales. The WCS had three goals at its core:

- maintenance of essential ecological processes and life-support systems;
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- preservation of genetic diversity; and
- sustainable utilization of species and ecosystems.

These goals were to be achieved through a participatory process, by developing conservation strategies to promote the integration of environmental, economic, and social goals in nations and smaller regions. The document identified six main obstacles to reaching these objectives:

- a belief that living resource conservation is a limited sector rather than a process that cuts across, and must be considered by, all sectors;
- consequent failure to integrate conservation with development;
- a development process that is often inflexible and needlessly destructive, due to inadequacies in environmental planning and management;
- lack of capacity to conserve, due to inadequate legislation and enforcement;
- lack of support for conservation, due to lack of awareness (other than at the most superficial level) of the benefit of conservation; and
- inability to deliver conservation-based development where it is most needed, that is, in rural areas of developing countries (Milbrath, 1989).

The WCS was one of the first influential documents to recognize the complementarity of economic and ecological goals. Many national and local strategies were initiated as a consequence of this document. However, many decision makers still perceived the document strictly as a plan to preserve wildlife or to designate protected areas, rather than as a holistic approach to planning, which would serve economic and social goals as well as environmental ones. The next step would have to be towards a more effective integration of these goals.

SUSTAINABLE DEVELOPMENT

Under the leadership of Gro Harlem Brundtland, the World Commission on Environment and Development (WCED) held hearings around the world throughout the late 1980s to explore the relationships among environmental, social, and economic objectives, and the future of the planet. The Commission’s report (WCED, 1987) responded to the need for a “global agenda for change,” and focused on the concept of sustainable development as a framework for integrating environmental goals into the mainstream of economic decision making. According to the report, sustainable development “meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). The central premise is that development is not the same as growth. While economic growth in some sectors or regions may be an important component of a comprehensive development strategy, development transcends narrow (particularly sectoral) measures of quantitative improvements. Development must be viewed as qualitative improvement, and must include social, economic, and ecological measures (Barbier, 1987; Daly, 1988). Development should be interpreted as improvement, rather than as just growth — and certainly not growth as defined solely through narrow economic indicators. The challenge of sustainability therefore encompasses the challenge of modifying some of the values that are central to our current modes of operation.
The message of the WCED report has been heard globally. In the midst of controversy over the precise definition of sustainable development, the report has brought an unprecedented number of people to the international table to debate and discuss "our common future." This crescendo of interest in the environment recently brought the heads of most world states, along with thousands of interested partners from business, industry, non-governmental organizations (NGOs), and special interest groups, to the 1992 United Nations Conference on Environment and Development (Earth Summit) in Rio de Janeiro in order to develop a plan of action towards a more sustainable future. Agenda 21 — the product of that conference — is essentially a "wish list" that emerged from this unprecedented level of global consensus; it is an agenda for reducing future risks for the planet and its inhabitants. Realizing the goals of Agenda 21 will require fundamental changes to the management of all sectors. Beyond Agenda 21, however, the real product of the Earth Summit has been an enhanced global awareness of the central role of the environment in the business and governance of the planet, the growing necessity and mandate to manage environmentally, and the urgent need for knowledge, skills, and tools with which to do so.

AN ECOSPHERE PERSPECTIVE

At the heart of the concept of sustainability is an ecological perspective of the planet and its component parts; it is a view of the Earth as an integrated system that provides the context and the basis for all human activity. The human race is increasingly the species determining the fate of the Earth, its ecosystems, and its inhabitants. As the human population swells and the consumption of resources by each individual increases, the pressures brought to bear on the planetary system also increase exponentially. As the magnitude and range of human technologies expand, our potential to alter the planetary system significantly also expands. Our power to make changes has grown more rapidly than our capacity to comprehend and manage the results. People are at the root of the global problematique; the solutions will have to be found in human thoughts and actions. Our future depends on our ability as a species to make the transition from environmental consumers to ecosystem managers.

Over the past few centuries, the human component of the global ecosystem or ecosphere has grown exponentially. People have become the dominant agents of change in nearly all parts of the world, altering natural ecosystems to serve their wants and needs. The "natural" part of the global ecosystem continues to shrink, due to active interventions, such as forest removal or intensive fishing, and to the unintended effects of our activities, such as soil erosion, water pollution, or acid precipitation. The effects of human impacts are increasingly evident at a global scale; perhaps the most immediate global concern is changes in the composition of the atmosphere, including changes in levels of stratospheric ozone and greenhouse gases, with potential for the disruption of many natural processes. Very often, the recipients of negative impacts are not the same as those who benefit from resource use. In fact, the recipients of negative impacts may be countries or continents away. For example, bioaccumulation through the food chain has rendered the food traditionally eaten by Inuit people in the most remote areas of the Arctic unsuitable for consumption in quantity (Government of Canada, 1991). Toxic substances carried by the wind from industries in Europe, North America, and Asia have concentrated in marine mammals to the point where it is no longer safe for the Inuit people to follow
their traditional diets. No one is immune to the effects of human activity.

Without a broad ecological framework as a point of reference, it is very difficult to comprehend or appreciate the complex interrelationships between human and environmental systems. In Figure I.1, an ecosphere model is presented that portrays the relationship between human activities and the natural resource base as one of supply and demand (based on Manning, Rizzo, and Wiken, 1990).

Supply: The Environmental Resource Base

In this model the environment, based on its biophysical characteristics, is viewed as the source of all goods, services, and experiences. Each part of the environment has the ability to support a range of the things all species require. Even though we may view an area as “in forestry” or as “farmland,” these environments serve a much wider range of functions than just wood production or food production. The environment (shown in the box on the left side of Figure I.1) supplies goods (e.g., food, wood, water, minerals, furs, soil), services (e.g., flood control, groundwater recharge, habitat, cleansing of pollutants), and experiences (e.g., recreation, aesthetic or sacred values, education). The ability of any part of the environment to maintain this supply is based on the specific biological and physical characteristics of each ecosystem.
Demand: The Human Factor

The demand side of the model, on the other hand, is driven by human numbers. The total human demand on the system is the result of population multiplied by the attitudes and expectations of each individual — the "footprint" of each individual on the planet. Together, population and individual consumption demands yield a list of needs and desires to be satisfied by the environment.

Western views concerning the use of resources have traditionally emphasized the satisfaction of human demands, portraying the environment primarily as a treasure trove of potential goods. Conventional economic approaches to the basic supply and demand question have focused on providing those items for which there is an active market and modifying ecosystems to serve immediate demands. The effects on other environmental values of satisfying these demands — drawdown of timber, water, fish, or mineral stocks, destruction of habitats, dispersal of toxic substances — have often been ignored in our economic measures. At best, environmental consequences are considered to be "externalities" — things that are difficult to measure and nearly impossible to value in traditional economic terms. Yet, the demands that the ecosphere must be able to satisfy over the long term include more than marketplace demands. They encompass the basic life-support systems for all species, including people. Clean air, water, and land, recreation, flood control, climatic stability, genetic diversity, and natural reduction of toxic contaminants are all important demands constituting a form of "life insurance" for people and the other inhabitants of the planet. Even if the marketplace does not readily demonstrate the value of these demands, they are just as real as the demand for consumer goods and services. An enlightened list of the demands to be satisfied from the planet — even an anthropocentric list — certainly should include life support for all species as part of a sustainable global system.

A burgeoning world population is at the root of the increased demands imposed on the ecosphere. When human populations were much smaller, their capacity for causing significant or lasting impacts was limited. When the waste products from nomadic herdsmen or a few villages entered a large stream, the pollution was readily absorbed as part of the natural cleansing function of that stream. The same system, however, will not absorb the waste of millions, particularly if the natural cleansing functions of the system have been diminished. We need only examine the state of the Yangtze, the Ganges, the Volga, or the Danube for visible evidence of this effect. If the flow of the system is reduced due to other actions (e.g., irrigation or diversion), the ability of the system to absorb pollutants can be further reduced, as in the Rio Grande, Nile, or Syr Darya (Aral Sea). Growing human numbers mean less environment, per person, to meet basic needs and absorb the impacts of human existence.

Transformation: Imposing Changes

The long list of human demands for goods, services, and experiences includes much that cannot be secured directly and locally from the environment. Therefore, a range of techniques has been developed to transform or relocate the products of the environment. These types of human action are shown in the centre box on Figure I.1. Technologies have increased human ability to combine materials to create what is wanted or needed (steel). Components are extracted from natural products (fibers, medicines) and recombined with others (alloys, synthetic textiles) to respond to our demands, however whimsical (perfumes, Frisbees). If the prod-
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...products are not where they will be used (coal, timber), systems transport them long distances to the market. These actions often have direct impacts on the environment by removing materials (gravel, wood products), or creating unwanted by-products (sulfur dioxide, toxins) that can denature areas of the environment. These feedback effects alter the characteristics of the environment and reduce its ability to continue to support essential functions.

MANAGING THE ECOSPHERE

An increasing percentage of the world's ecosystems are becoming managed systems — agro-ecosystems, managed forests, and urban systems. The world's ecosystems are being altered fundamentally to serve specific, often short-term, human wants or needs. The biodiversity of large areas is being significantly reduced, with little knowledge of the risks, or even of what is being lost. At the same time, the built environment is expanding, often at the expense of fragile or potentially productive ecosystems, as cities expand into surrounding wetlands, arable soils, alluvial plains, and other productive ecosystems. If these changes are not well understood and effectively planned or controlled, they threaten the ability of the entire system to support other functions required by all species.

Actions that enhance part of the environment for a particular purpose can have repercussions for the ability of the ecosystem to serve the full range of demands. Clearing land to enhance its ability to grow crops alters its ability to support wildlife or provide recreational opportunities and may also impact on its ability to serve a role in the larger system (e.g., migratory bird habitat, erosion control). Even activity that is apparently positive with respect to certain social or environmental values, such as setting aside nature preserves or draining swampy areas to improve crop production, constitutes an allocation of environmental resources enhancing certain functions at the expense of others. Effective integrated management of environmental resources will be a key building block towards a sustainable future, aimed at retaining the resiliency of the environment to serve the changing needs of humans and other species.

Much of the North has achieved very high living standards, in terms of consumption levels, through the development and application of technology, and through virtually unlimited access to the resources of the globe. More often than not, these consumption levels have been maintained by depleting environmental capital (such as forests, minerals, energy, and wildlife), rather than living off the interest and dividends that accrue from environmentally sound management. The North continues to export a growth ethic to the developing world, without providing the means to deliver it on a sustainable basis or to cope with the results of the adoption of that ethic at a planetary scale.

How can we manage our demands on the ecosphere so that all members of the global community may live well, within the limits and opportunities of the system? Can we manage the nature and extent of human demand so that it peaks at a level that is sustainable within the carrying capacity of the global system? Can we develop and successfully exchange management methods that are aimed at demand management — population control, reduced material expectations, and more efficient supply of basic needs? Fiscal responsibility is often cited by firms or governments in calling for the reduction of budget deficits; similarly, ecological responsibility implies managing the full range of demands on the environment to keep them within the limits of ecosystem
resilience, carrying capacity, and sustainability. Failure to do so creates an environmental deficit, which — if our human systems are to survive — will have to be paid back by future generations. Good management must therefore be responsible, broadly based, and knowledgeable. It must recognize the need for ecological insurance, allowing a margin of safety for those resources fundamental to the long-term survival and viability of ecosystems, as well as their continued ability to support and enhance human life and activities.

**STEPS TOWARDS SUSTAINABLE MANAGEMENT**

To a great extent, the history of the world community with respect to the environment can be seen largely as a history of trying to change the environment (supply) to serve human demands. Achieving sustainability, however, requires giving at least as much attention to the management and control of demands, and to the modification of transformation processes. A truly sustainable approach to development internalizes, respects, and builds upon global ecological limits and opportunities. Achievement of a sustainable future is increasingly contingent upon our ability to control and direct human activity, and to manage effectively the interface between human and natural systems.

**Environmental Supply Management**

There is a need to understand and manage environments for a broader range of products and values than we have done in the past. In addition to managing the resource base upon which our individual, societal, or corporate economic success is directly dependent, managers will have to account for:

- downstream effects, such as erosion, pollution, solid waste, impacts on water supply, impacts on adjacent habitats;
- costs at different scales, such as the effects on the region, the local ecosystem, or the global ecosphere (e.g., acid precipitation, carbon dioxide emission levels, genetic diversity, global warming);
- risk reduction (environmental, economic, social), such as flood risk or health risk, particularly at the community level;
- long-term integrity of the ecosystem of which they are a part;
- maximum use of resources harvested, through minimization of the waste stream, re-use, and recycling; and
- efficient management of energy use (Manning, 1991).

More holistic management of environmental resources will not be easy. It will certainly require more and better information on the attributes of the environment and the values derived from given environments. New approaches to planning will be needed, involving larger regional scales and integration of environmental and community interests early in the planning and development process. Better means of anticipating impacts and monitoring for important changes in the state and use of the environment will be needed. Few managers have the tools to allow them to understand the problem clearly, let alone to craft successful responses.

**Demand Management**

The demands humans place on the ecosphere are a function of both our numbers
and our expectations. To reduce stress on the system, we will need to:

- develop effective ways to reduce population increase to levels compatible with long-term carrying capacity (this will involve a broad range of management approaches, generally in the field of social and demographic planning);

- find ways to reduce material demand (notably in the North) and to help modify expectations globally away from a high-consumption model (this will require means to effect substitution of quality for quantity, experiences for things — leading to satisfying and sustainable lifestyles);

- devise means to reduce the net impact of human activity on the environment through technological improvements and behavioral change (we can begin in the area of energy efficiency and waste management, in reducing the footprint of each individual and each industrial transformation process).

Managing Our Technologies

While some technologies are part of the problem of increased stress on global systems, many are potential building blocks in the implementation of sustainable solutions. The key will be to select and promote those technologies and processes that aid in the maintenance of sustainable systems or that advance our understanding of the functioning of the planetary system. Decision makers will need better access to information on what works, knowledge of cases of best practice and success stories, and clear indicators of which technologies are compatible with overall system sustainability and which are not. Given the growing public demand that managers accept both legal and ethical accountability for their actions, better information on the impacts and by-products of our technologies is becoming an essential management need.

INSTITUTIONAL CHANGE: MANAGERS AT THE FOREFRONT

New institutions and institutional links will be essential in order to address sustainability concerns at appropriate scales — global, regional, or local — and in new spatial constructs such as eco-regions or watersheds. New means of managing common property resources and of defining common futures are increasingly needed. Processes such as conservation strategies, roundtables, and community consultative procedures can contribute to the formulation of a collective vision of the long-term future. The challenge for decision makers is to participate fully in such procedures in order to comprehend the broader dimensions of their management task. Later chapters of this volume review in detail some of the promising approaches that are emerging from attempts to undertake comprehensive, ecosystem-based approaches to economic development.

Clearly, our present institutions are not designed to adapt well to the challenges of the new environmental paradigm. Many institutions remain based on the unlimited growth premise of the past two centuries. They have not yet developed or internalized the means to manage effectively within a new paradigm based on sustainability and management within carrying capacities. In general, current organizations fall short in the following ways:

- they are focused on a single objective, and are responsible and accountable only for that objective;
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> their area of jurisdiction is defined in political or administrative terms that do not match the spatial extent of the problems with which they must deal, particularly the cultural or ecological dimensions of them;

> they are frequently limited to specific approaches or disciplines that have become embedded in the corporate culture;

> their rewards system is designed to reward single-dimensional measures of efficiency;

> they lack strategic partnerships and effective links to develop joint plans for achieving common goals with other sectors, other specializations, and other regions; and

> they therefore have neither the purview nor the capability to manage the key inputs to their endeavor, or the impacts of their actions.

The full integration of environmental factors into the decision process will occur only through institutional change, including the evolution of current institutions to incorporate the dimensions and challenges of sustainable management, as well as the establishment of new cross-sectoral and collaborative institutions and institutional links.

Decision makers need to be more aware of their critical role in the management of the planet and its component systems. Every manager is, in some way, an environmental manager. Every manager depends on the continuing function of the system for the prosperity of his or her enterprise, and every decision affects the environment, either directly or indirectly, positively or negatively, by design or by accident. The foundation of a sustainable future will be the effective re-education of our existing cadre of managers and decision makers, to provide them with the understanding and the tools to create and maintain sustainable systems. At the same time, an effective means of integrating environmental knowledge into the education systems of all nations must be sought, to allow them to strengthen their own capacities for managing towards long-term sustainability.
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REFERENCES


