Defining a Sustainable Society

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Introduction

This chapter provides a working definition of sustainability that can be used to describe a sustainable Canadian society. A set of general principles of sustainability is articulated, and it forms the basis for the discussion in subsequent chapters. Chapter 4 describes the scenario design criteria used to translate the values and principles articulated in this chapter into inputs to the sustainability scenario. The results of the scenario analysis are set out in Chapter 5, and some of the policy and economic implications of the scenario are explored in Chapter 6.

The Concept of Sustainability

Over the past quarter century, there has been a growing recognition of the harmful effects and economic costs of continued environmental degradation. Official recognition of these problems is reflected in the establishment of environmental agencies, ministries, and other organizations, the growth of environmental policies and regulations in both the public and private sectors, and the growing political profile of environmental issues.

Initially, concern with environmental issues focused mainly on short-term and local effects. More recent analysis has concluded that human activities may be causing significant effects on global biogeochemical and biogeophysical systems, with potentially large-scale and long-term impacts. The best-known examples of these global effects are climatic warming due to greenhouse gases and ozone depletion due to the emission of CFCs (IPCC 1992). The extent of the potential impacts has led scientists to suggest that we are conducting what amounts to a global experiment on the biosphere, with potentially fatal consequences for humanity (Environment Canada 1989).

In order to address such problems, we need to consider the social causes and impacts of the human activities that underlie them. This consideration, in turn, raises some important questions about the fundamental character of our society. For example, it has been argued that environmentally destructive human activities are based on behaviour that is deeply rooted in modern industrial civilization's underlying assumptions and beliefs about nature and humanity's place in it (Naess 1973; Capra 1983; Berman 1984; Devall and Sessions 1985; Suzuki 1994; McLaughlin 1993). Others see the negative environmental consequences of such activities as connected to other negative social characteristics of modern society, such as poverty or social alienation, and argue that the exploitation of nature by human beings is closely connected to the exploitation of humans by other humans (Leiss 1974; Bookchin 1986). It is therefore necessary to consider the social attitudes and practices that give rise to environmental (and social) impacts.

From this perspective, the concept of sustainability goes beyond the continued existence of biophysical life-support systems. Because of these broader questions about the cultural roots of human activities and their social consequences, sustainability issues have sociopolitical dimensions as well. They have to do not simply with the alteration of certain social practices that give rise to unpleasant environmental consequences but also with the underlying causes of those practices, and with the linkage between sociopolitical and environmental states. In other words, a sustainable society must be sustainable in both environmental and sociopolitical terms.

This was also the conclusion reached by the World Commission on Environment and Development (1987:8), commonly known as the Brundtland Commission. According to the commission,

Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits – not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effect of human activities.

While adopting this orientation of the Brundtland Commission, we recognize some of the concerns about the concept of sustainable development expressed from within the environmental movement:
To some in the environmental movement, [the term 'sustainable development'] sounds positively sinister. Their fears are that the phrase will become a code for legitimizing all development so long as there is some token environmental scrutiny of it. But for all environmentalists, including myself, that approach is simply not good enough. It is a continuation of the route that brought us to our present difficulties. A far more pervasive approach to incorporating environmental values into routine economic decision-making is needed. (Holtz 1988)

The underlying concern expressed is the degree to which the sustainable development argument simply paper over serious differences between pro-growth and anti-growth arguments and deflects attention from the real sociopolitical and economic changes required. We recognize that ecological and social sustainability may well imply patterns of economic and social development that are quite different from those implied in traditional views of continued economic development. The challenge is to articulate and test the degree to which such changes are required if we are serious about the concept of sustainability.

Sustainability as an Ethical Principle

While the practical reasons for concerns about sustainability are compelling, they do not by themselves provide an adequate basis for developing design criteria for a sustainable society. Although the concept of sustainability has been discussed at length (Clark and Munn 1986; Rabinow 1987; Brown et al. 1987; World Commission on Environment and Development 1987; United Nations Conference on Environment and Development 1992; World Resources Institute 1994), there has been relatively little discussion of the underlying ethical principles of the concept. We begin with two observations about the relationship between human beings and the natural world.

First, the survival of human beings depends utterly on the environment for air, water, food, and material resources, and to serve as a sink for their wastes. Its continued existence is a prerequisite for the existence of human society. Second, humanity does not understand much about the complex sets of interactions and processes of the biophysical world around us. That is, a significant degree of ignorance about the external world is characteristic of the human condition. This ignorance suggests that a basic caution is in order when interfering with natural processes.

These two observations provide a practical, albeit anthropocentric, justification for concern about sustainability. However, we wish to combine this justification with an assertion of the ethical principle that the existence of the natural world is inherently good. That is, the natural world and its component life forms, including humanity, have value by and for themselves. (This belief, in turn, is based on the assumption that affirming the intrinsic value of the natural world and of humanity is not self-contradictory.) Such a principle provides an ethical basis for valuing sustainability and for affirming autonomy in nature.

This principle, which is present in some form in many cultures and religions, is a fundamental ethical principle that need not be justified in terms of any other value. For our purposes, however, it is based on the assumption that life evolves something like the way suggested by current evolutionary theory, which suggests that there is a process of selection through which the natural world determines what is sustained. This selection follows a dynamic pattern, which in itself is a continuing affirmation of our ethical principle. With respect to sustainability, this means that the environmental/ecological sphere must be able to regenerate itself through natural evolution. And if it does, our ethical principle suggests that it will thereby be able to contribute in its own creative ways to the enrichment of life as a whole. Thus, continuous regeneration of the natural world becomes a basic value.

The assertion that the continued existence of a world and the life on it is a good thing does not, however, tell us enough about what kind of things should be sustained and where, or about how we should behave. For example, it is not clear a priori that any component of the biosphere, such as a specific species, forest, or ecosystem (let alone any particular social practice, such as parliamentary democracy or market economics), should be valued in itself. However, it does imply that those characteristics of natural systems that are the result of biophysical evolutionary process are valued characteristics of the natural world. We then have to rely on ecological science in order to obtain the best current understanding of natural biophysical process. We will make use of this approach in our discussion of the principles of environmental/ecological sustainability below.

Considering the ethical underpinnings of humanity's treatment of the natural world is not enough, however. In keeping with the general conceptualization of sustainability introduced above, we also need to discuss the ethical dimensions of sustainability as they relate to sociopolitical issues. To do so, we begin with another principle: nature's gift of self-consciousness is, as far as we know, the trait that distin-
guishes humans from other animal forms. It is the source of all concepts of the relationship between humanity and the natural world, of all technologies, and of moral responsibility. We combine that principle with the observation that the development of modern industrial society presupposes the existence of a type of science and technology that is historically unique, and uniquely capable of transforming the natural world and human capabilities. Thus, we need to be concerned with the moral dimensions of sustainability, in terms of the particular form that human self-consciousness takes, as expressed in sociopolitical organization and human behaviour.

Such self-consciousness is gained by the capacity of the mind to work symbolically, that is, to represent to itself alternative states of existence and to create different 'universes of meaning' (e.g., ideologies, religions, and worldviews). Sociopolitical systems are universes of meaning that structure the evolution of individual and collective practices, and the institutions that make such practices possible. A successful universe of meaning has cultural sustainability that, in sociopolitical terms, rests on the ability of the system to claim the loyalty of its adherents. This loyalty, in turn, requires the propagation of a set of values that, in the long run, is acceptable to the populace, and it requires those sociopolitical institutions that make the realization of those values possible.

Required, therefore, are sets of sociopolitical practices that foster cultural as well as environmental sustainability. These need not be entirely separate considerations. Indeed, as suggested above, several prominent streams of environmental thought have argued the existence of a strong link between the sociopolitical and environmental behaviours characteristic of modern industrial society. The point is simply that an ethical affirmation of the value of the world and its inhabitants provides a basis for principles of sociopolitical behaviour that affirm the value of both the human and non-human.

The preceding discussion provides both practical and ethical arguments for sustainability, and some indication of the dimensions of sustainability that are of interest. We will now attempt to interpret those arguments in terms of a definition of sustainability.

**Sustainability Defined**

**A General Definition**

In our view, the Brundtland Commission's definition of sustainable development provides an appropriate starting point. Its emphasis on meeting human needs and on sustaining the capability to continue meeting such needs provides a useful focus for applying the concept of sustainability both biophysically and sociopolitically. Another important characteristic of the WCED analysis is the explicit link made between social and environmental problems. At the same time, we need to be wary of treating the symptoms rather than the disease, and of confusing growth with development (Daly 1991; Daly and Cobb 1994), and we need to press for more far-reaching changes in beliefs, attitudes, and social practices than are implied in some of the Brundtland language.

For our purposes, therefore, *sustainability is defined as the persistence over an apparently indefinite future of certain necessary and desired characteristics of the sociopolitical system and its natural environment.*

This definition has several important components. First, the phrase 'apparently indefinite future' has been chosen to reflect the facts that we cannot, and would not want to, guarantee persistence in perpetuity. Such guarantees would be meaningless in practice, because we simply cannot usefully predict that far ahead. Moreover, they would be undesirable in principle, because we don't want to preclude the possibility of desirable change, even in those characteristics of the system we now like. (For example, what we consider desirable and indeed necessary in Canada in 1993 is much different than what the inhabitants of this land, or indeed of Europe, would have said 500 years ago.)

We instead want to ensure, as far as possible, the persistence of those characteristics of Canadian society and its natural environment that we consider necessary and desirable. At the same time, we want to allow for alterations in those characteristics, and in Canadians' interpretations of them. That is, we want to preserve the capacity for the system and the environment to change.

Second, the definition incorporates both necessary and desirable characteristics of the system and the environment. There are several reasons for this. Perhaps most importantly, it is hard to separate necessary characteristics from desirable ones. In the social realm, there is no consensus on the defining characteristics of human society, let alone the necessary conditions of survival for that society, beyond such basics as meeting the survival needs of humans and providing for the nurturance and socialization of the young (Giddens 1984). In the biophysical realm, while minimum conditions of biological survival at the individual level seem straightforward, we do not know enough to describe in detail all of the biophysical processes that maintain those conditions, let alone the necessary states of such processes.
Moreover, the value-ladenness of science and the degree to which it is socially contingent (Clark and Fujimura 1992; Pickering 1992) suggest that it may not ever be possible to determine the necessary conditions of either environmental or societal sustainability unambiguously, or to separate these from merely desirable conditions. These reasons support the view that sustainability is ultimately not a scientific concept but a normative principle.

Third, conceiving of sustainability in normative terms involving necessary and desired characteristics raises the question of who is to decide what those characteristics are and how such decisions are to be reached. This question underlines the importance of the sociopolitical dimensions of sustainability. For sustainability to be acted on, it must be possible for the desirability of environmental and sociopolitical characteristics of the world to be determined and expressed in the political realm. Yet as noted above, the idea of cultural sustainability implies the need for cultural values, and sociopolitical practices and institutions, that are acceptable to the populace. This general acceptance rules out environmental autonomy as a feasible or desirable response to the problems of unsustainability.

Fourth, our definition implies that there is no single version of a sustainable society. We make no claims to be describing the only possible sustainable society for Canada, or the only one that would correspond to the definition.

Fifth, the implications of the concept of sustainability adopted here mean that the term 'sustainable society' is more appropriate for our purposes than 'sustainable development.' As noted above, we do not want to be constrained by traditional views of economic development. Moreover, society is a much broader concept than development, and allows us to encompass some of the wider issues discussed in this chapter. However, we also recognize the need to provide analysis that can connect with real-world concerns, decision-making processes, and the time required for completion of fundamental changes.

Thus, our strategy is to combine an analytical focus on concrete possibilities for sustainability in the relatively near term (i.e., forty years) with explicit consideration of more far-reaching changes beyond then. The scenarios developed in this project do not describe the full set of transformations required in Canadian society. Not only will the transition be incomplete at the end of our story line, but the definition of necessary and desirable characteristics of sustainability can also be expected to change over that time period. The scenarios do describe the characteristics of a more sustainable society at the scenario endpoint and do attempt to outline some of the changes needed if Canada is to move in the direction of such a society. Our scenarios cannot show the changes required to attain sustainability, only some changes that might make Canada more sustainable.

The concept of sustainability outlined here has been described in very general terms. To make it more concrete and useful for analysis, we need to clarify some important definitional problems. The first has to do with the need to describe clearly just what is to be sustained. The second is concerned with the time period over which the sustainable society must be determined. The third has to do with the need to measure or assess sustainability for it to be a meaningful criterion.

**What Is to Be Sustained?**

Precisely what must be sustained if Canadian society as a whole is to become sustainable? This is not a simple question. First, the definition's emphasis on 'characteristics' of the system and its environment is intended to suggest that increasing the sustainability of a system is not equivalent to maintaining that system in its current form. Such attempts may indeed increase unsustainability. The social and political structure of France in 1785, for example, was not sustainable and could not be maintained in the face of the social pressures that led to the French Revolution. In fact, attempts to preserve unsustainable social practices can contribute to the eventual overthrow or reform of those practices. Similarly, in the ecological realm, the work of Holling (1986) and others has shown that attempts to manage or control certain aspects of, for example, a forest ecosystem can make it vulnerable to collapse as small changes accumulate or low-frequency but extreme natural events occur.

To use Holling's terminology, the goal is not to increase the reliability (resistance to breakdown) of the systems being considered but to increase their capacity to recover from disturbance. The metaphor is that of safe-fail systems (which can fail 'gracefully' without catastrophic repercussions), rather than fail-safe systems (which are less liable to break down initially but collapse entirely when breakdowns occur).

Second, it is not always clear what should be sustained. For example, the changes in European society, culture, and institutions over the past several hundred years have been substantial. Few, if any, characteristics of any European country have been retained untouched, including even the physical boundaries of many countries. Yet we clearly would want to claim that there has been continuity, that it makes sense to talk...
about ‘English’ or ‘Italian’ history or culture. Such considerations suggest the need to be very clear about what we are interested in preserving in the social realm.

In the natural realm, if we want sustainable forests, we must clarify what that means. Are we trying to sustain the current forest community, at its current successional stage? Are we trying to sustain a certain level or type of biomass production, or a certain annual allowable cut? Do we assume that current forest uses will continue to be predominant? Perhaps we should simply try to sustain the capacity to grow forests. This suggests shifting the focus to the soils on which the forests grow. But what about the wildlife in the forests?

One approach to these problems is to recognize that different levels of systems exist, and that sustainability is a property of the highest, most general level being considered, not of the constituent parts of that system. Given this view, it is first necessary to identify the overall system of interest, and then to consider the sustainability of that system as a whole. Using our two examples, we are concerned with the sustainability of a certain type of society and of a particular forest ecosystem. This may or may not mean that any specific components of that society or that forest should be sustained. Rather, it is Canadian society, and the natural processes on which that society is dependent, that should be sustainable. This may or may not require sustainability for particular component subsystems.

This position clarifies some of the issues but leaves important questions unresolved. How do we define Canadian society and the natural processes on which it is dependent? How do we resolve conflicts or trade-offs between different subsystems? And it raises some new problems. Does it make sense to talk about a sustainable society in Canada if the rest of the world is not sustainable?11

A third problem relates to the undesirability of certain kinds of sustainability. Clearly, there are some social conditions and practices that we don’t want to sustain, such as widespread poverty or crime. Are these to be taken as examples of conditions that are undesirable whether or not they are sustainable, or are they themselves evidence of unsustainability? Some of the longest-lived human societies have been those in which social practices such as slavery, which we would clearly want to label as undesirable, have been prevalent. This suggests that sustainability defined as mere persistence over time is not a sufficient basis for the evaluation of desirability, at least not without being defined in a way that incorporates such concerns.

These examples suggest that important judgments be made about what specifically should be sustained in order to ensure the sustainability of Canadian society. It is also clear that our concern should be more with basic natural and social processes than with the particular forms that those processes take at any time.

The Time Period
The question of the time period over which sustainability is to be assessed is greatly complicated by the existence of an array of social and natural processes with much different time scales. Individual human beings live up to about 100 years; individual trees, depending on the species, several times that long. Some social practices, such as clipper shipbuilding, have quite short lifetimes; others, such as marriage, span millennia of human history. The same is true of natural processes. Moreover, the lifetime of individual members of a class of social practices or biological species is much different than the lifetime of that class as a whole. The lifetime of democratically elected governments, or individual trout, is measured in years, yet democracy and trout are themselves much longer lived.

It is often asserted that the mismatch between the longer time scales of many natural processes and the shorter ones typical of human decision-making is a major reason for the lack of environmentally sound decision-making (Holling 1986). Yet this point needs to be stated carefully. The distinction is not between the long time horizons of natural processes and the short ones characteristic of social processes. As suggested above, many social processes and practices also have long lifetimes.13 The concern is with the disparity between the time horizon of individual human decisions and that of the natural processes affected by these decisions. However, the same point could be made about social processes. Individual human decisions, often with very short time horizons, may alter the nature and viability of social practices and institutions characterized by long lifetimes and far-reaching effects on human activity. We therefore need to be concerned with the sustainability of both natural and social systems and processes over the longer term.

To a certain extent, the problem of time horizons has been determined for this project by the selection of a forty-year scenario-analysis period. This is longer than typical social decision-making horizons, but shorter than the time scale of many of the natural and social processes with which we are concerned. Therefore, as suggested above, the goal must be to devise scenarios that increase the sustainability of processes...
over the forty-year time horizon, but that are also directed toward a continued increase in, or at least a maintenance of, sustainability beyond this period. This approach suggests the desirability of also considering the direction of change with respect to sustainability in the endpoint year, and the continuation of that trend beyond 2031.  

The Measurement Problem
Space and time variables complicate measurement. If sustainability is a moving and ambiguous target, and if it necessarily manifests itself over periods longer than that of analysis for this project, there would seem to be some serious difficulties in the way of assessing the sustainability of the scenarios. There are several points that need to be made here.

First, as noted above, it is not meaningful to assess the absolute sustainability of any society at any one point in time. The best that is likely, even in principle, is to assess rather crudely the relative sustainability of the society compared with, say, earlier states. And this assessment will depend on developing a rather precise description of what is meant by sustainability and of what is being sustained.

Second, the ability to develop even relative judgments of societal sustainability depends rather directly on the state of knowledge about social and ecological processes in and around that society. There are two dimensions of interest here: the state of knowledge about the nature of those processes (i.e., theoretical knowledge), and the amount of available data describing those processes.

With respect to theoretical knowledge, the basic science of ecological processes is in its infancy, while not only the possibility but also the desirability of formal theory in the social realm is disputed. On the data side, the situation is little better. For example, there is a great dearth of information about even the physical interactions between natural and social systems. Our large national databases and statistical agencies have not been designed to allow the gathering of information on these interactions (Potvin 1989). The result of these factors is that only very approximate types of information are available.

This dismal situation is mitigated on the socioeconomic side by the existence of the Socio-Economic Resource Framework (SERF), the modelling system used in this project. SERF (described in more detail in Chapter 2 and Appendix B) represented not only the most comprehensive set of socioeconomic data in Canada but also a formal simulation capability based on human activities described in the terms most suitable for linkage to environmental processes.

However, as discussed below, the SERF model only represents human activities; it contains no explicit representation of biophysical phenomena. Moreover, those activities are described in terms of physical quantities that are not linked in a clear way with social issues such as justice, democracy, equity, and so on. The upshot is that it was not possible to develop precise measures of sustainability in this project. Instead, only qualitative judgments were possible of whether the scenario outputs from SERF conformed to the scenario design criteria based on the values and principles outlined in this chapter. (See the discussion of scenario design criteria in Chapter 4.)

From the General to the Specific
The problems of deciding exactly what must be sustained in any given case, of choosing an appropriate time period, and of devising useful measures of sustainability suggest the wisdom of retaining our general definition of sustainability. Any attempt to develop a more precise definition would not only run up against these three problems but also run the risk of contradicting our arguments regarding the need to allow perceptions of necessary and desirable conditions of sustainability, and the natural and social systems themselves, to change.

This does not mean, however, that we must resign ourselves to the inability to say anything concrete about sustainability. While the concept itself remains general, its interpretation and application in particular circumstances will necessarily be specific. It will always be possible to develop more concrete principles that apply the general concept of sustainability to the circumstances of interest. In the case of our project, this meant the development of environmental and social principles of sustainability that, if applied, should reduce unsustainability and reinforce sustainability in Canada over the next few decades, as seen from our current understanding and ethical standpoint.

Environmental/Ecological Sustainability
The term 'environment' in the most general sense refers to anything external to some reference point. In systems theory, it refers to anything external to the perceived (or artificially defined) boundaries of some system that can affect the functioning of that system. 'Ecosystems' are populations of plants and animals sharing preferred habitats that interact among themselves (as 'natural communities') and with the abiotic components of their environments. From this ecosystem perspective, the environment includes solar energy, air, water, and minerals, which
all provide 'life support' for living things. The concept of the ecosystem has evolved over the years (McIntosh 1985). It originally placed an emphasis on the importance of nutrient (biogeochemical) cycles and the flows of energy through natural systems. More recently, the spatial patterns of ecosystems have also been emphasized, particularly in the emerging field of landscape ecology (e.g., Moss 1988) and conservation biology (e.g., Scott et al. 1987).

Ecosystems evolve over time, and the general sequences of successional changes have been described in terms of characteristic features and functions (e.g., Odum 1975; Borman and Likens 1979; Holling 1986). Later stages of succession are generally more persistent and self-sustaining than earlier ones, but they are also subject to change through natural agents such as fire, drought, floods, ice storms, tornadoes, and (in the case of aquatic systems) sedimentary in-filling. These changes serve to maintain spatial 'patchiness' in terrestrial ecosystems and concentrated 'centres of biological organization' in aquatic ecosystems. Hierarchy theory suggests that local 'catastrophes' that maintain a mosaic pattern within ecosystems are in fact necessary for overall ecosystem functioning, because they provide space for regrowth and renewal.

Humans depend on ecosystems for basic life support, for natural resources, and for the disposal of wastes. Humans add to the patchiness of ecosystems by transforming landscapes for intensive urban-industrial and agricultural uses. Together with other resource management practices, large proportions of regional ecosystems are in effect maintained as 'anthropogenic subclimaxes,' and often show evidence of degradation in their structural or functional properties (Rapport et al. 1985). Humans also derive important non-economic values from ecosystems, and there is philosophical debate over the ethical or metaphysical responsibilities that humans have for ecosystems. The ethical principles articulated above represent one possible approach to these issues.

To ensure the ecological sustainability of society, the basic goal must be to keep options open and enhance them where possible. Three strategies should thus be pursued.

First, the life-support systems must be protected. In practice, this will require the decontamination of air, water, and soil by assuring the virtual elimination of discharges of toxic substances, especially those that bioaccumulate and biomagnify in organisms. Priority must go to eliminating the release of artificial 'xenobiotic' compounds that are alien to ecosystems not 'preadapted' through evolutionary experience to absorbing and decomposing such compounds benignly. Other kinds of pollutants, such as organic wastes, must be reduced to levels that do not impair ecosystemic functions by overloading their capacities to process them. Environmentally benign farming and forestry practices must be promoted to reduce reliance on pesticides.

Second, biotic diversity must be protected and enhanced, in part through special measures to protect relatively undisturbed or sensitive ecosystems in the overall context of landscape mosaics considered at different levels of scale and detail. Guidance is provided by a hierarchical framework for defining ecological regions in Canada (e.g., Rubec and Wiken 1984), and the diversity itself must be considered from different levels of overall mosaics, natural communities, particular species, and individual populations of species of particular importance.

Third, resource management strategies must maintain or enhance the productivity of ecosystems through careful management of soils and nutrient cycles. Rehabilitative measures will be needed for badly degraded ecosystems resulting from resource extraction, overuse, or pollution.

These three strategies correspond generally to the threefold categorization of environmental issues introduced in the World Conservation Strategy: maintenance of essential life-support systems, enhancement of biotic diversity, and sustainable resource use (IUCN/WWF/UNEP 1980). In addition, strategies must be developed to adjust to climate change, which is expected to occur over the next half century. Even if measures were taken to reduce the accumulation of greenhouse gases causing this change, the trends are practically irreversible over the next couple of decades because of the inertia in many biogeochemical systems, as well as in institutions (International Panel on Climate Change 1992). Some of the projected changes in Canada include (Atmospheric Environment Service 1987):

- a lowering of the Great Lakes by up to one metre
- a rise in coastal sea levels of between 0.2 and 1.4 metres
- shifts in the distribution of forest biomes of up to several hundred kilometres, generally to the north and east
- extensive drier zones and greater variability in crop yields in the southern Prairies
- a northward migration of agriculture in some areas due to longer growing seasons that will, however, be limited by poor soil conditions
- a general increase in the frequency and severity of droughts.

There is considerable uncertainty about the rates at which these changes will occur, and to what extent they will have emerged by 2030. A network of 'early warning' monitoring sites is needed. However, the
degree of scientific consensus about the likelihood of such change, and the scale of impacts involved, suggests the need to develop preventive and adaptive strategies. Of particular importance in this regard, given the dominance of greenhouse gas emission associated with energy production and use, is the development and implementation of policies for increasing energy efficiency and switching away from fossil fuels. More generally, the challenge is an institutional one of keeping options open and developing the capacity to adapt or adjust to 'surprises' of all kinds (e.g., Clark and Munn 1986).

**Sociopolitical Sustainability**

The sociopolitical realm encompasses all human activities and behaviours, including institutional arrangements and activities. For our purposes, it can usefully be conceived as consisting of individual behaviours on the one hand and the activities associated with collective decision-making on the other. Following Dryzek (1987), we will refer to the latter activities under the rubric of ‘social choice mechanisms,’ or organized approaches for making collective choices. Examples are the market, the legal system, voting, bargaining approaches, rule by command, etc.

Social choice mechanisms interact with individual behaviour in various ways. Some of these mechanisms, such as the market, are based on the aggregation of individual consumption choices, while others, such as rule by command, involve more direct and centralized control of individual behaviours. In practice, the relationship is always mediated by social rules and institutions that translate individual behaviour into collective action and vice versa (Burns and Flam 1987). In every case, however, there exists some distinction, and potential tension, between individual and collective behaviour.

The sociopolitical realm as a whole, therefore, consists of a set of social choice mechanisms, expressed in the form of institutions and social rules, and a set of individual behaviours variously constrained or influenced by those collective mechanisms. One important form that such influence takes is in the set of institutions and rules used within a society for economic and political decision-making.

From the point of view of sustainability, as defined above, two aspects of sociopolitical behaviour are of interest. First, there are the constraints on human behaviour imposed by the need to promote sustainability in the environmental/ecological realm. Second, there are those characteristics of the sociopolitical realm that are desirable in themselves from the point of view of sociopolitical sustainability. We will deal with each of these in turn.

**Environmental/Ecological Constraints on Sociopolitical Behaviour**

The preceding section of this chapter outlined a set of conditions to be met to increase the sustainability of ecological systems. Most or all of those conditions implied the need for changes in the ways that humans interact with their environment. Such changes will be reflected in different behaviours at the individual and collective level. The issue is the specific nature of these different behaviours, and the degree to which they require significant alterations in, say, institutional design, economic organization, or political decision-making.

One way to assess the sociopolitical requirements for sustainability is to assess the capability of different social choice mechanisms to meet minimal standards of ecological rationality. An important attempt to do this can be found in the work of Dryzek (1987), who argues that none of the social choice mechanisms currently dominant in Western society meets such standards. While there are significant differences in the capabilities of, say, markets or polyarchical political systems to promote ecologically rational behaviour in particular circumstances, they all suffer, he argues, from a common characteristic, which is fatal to any attempt to promote ecologically sound human behaviour at a more general level. This common characteristic is a reliance on instrumental rationality as the basis for human decision-making. Such reliance precludes adequate treatment both of ecological systems characterized by teleology and emergent properties and of questions of ecological or social value that have to do with ends and not means. Dryzek proposes, instead, the development of social choice mechanisms based on the concept of practical reason and radical decentralization of political and economic decision-making.

Dryzek's analysis led him to postulate a set of general criteria that would have to be satisfied in order for a social choice mechanism to be ecologically rational, that is, to have the capacity to resolve ecological problems. These criteria are:

- negative feedback between social choice mechanisms and ecosystems, which permits information about ecological dysfunctioning to be expressed readily and effectively
- coordination across and within collective actions undertaken in response to environmental problems
• robustness or flexibility in response to changing environmental conditions
• resilience in the face of severe environmental disturbance (Dryzek 1987: 46-54).

Dryzek's arguments represent one example of a large literature, noted at the beginning of this chapter, suggesting that the nature of environmental problems requires a fairly significant restructuring of social behaviour and decision-making. His work is cited here because his approach is compatible with ours, whereby general principles of sustainability are articulated in terms of which specific design criteria can be developed.15 For our purposes, however, it will be useful to translate his rather general criteria into more specific principles, in the context of the discussion above. In particular, we concentrate on the development of several economic and political principles intended to respond to the idea of environmental constraints.

We begin with the issue of growth. There exists considerable disagreement on the question of whether environmental limits to growth in human activities are being approached in practice or whether they can be indefinitely deferred due to technological advances and the resultant substitution of human-made capital for natural capital. But clearly the overall scale of human activity, in terms of both resource use and waste assimilation, must be kept below the total carrying capacity of the planetary biosphere. In this regard, it is useful to keep in mind the distinction between growth and development drawn by Herman Daly (1991:243): "Much confusion could be avoided if we would agree to use the word "growth" to refer only to the quantitative scale of the physical dimensions of the economy. Qualitative improvement could be labelled "development" ... Growth of the economic organism means larger jaws and a bigger digestive tract. Development means more complete digestion and wiser purposes." In practice, this principle suggests the need to consider seriously the question of when and how it will be necessary to impose absolute limits on the overall growth in the physical scale of the economy.

In addition to being concerned with the rate of growth of overall activity, we need to consider the substantial negative impact of current economic activity on the natural environment. The issue here has to do with the pervasiveness of what economists call externalities and other forms of market failure connected with the extraction, use, and disposal of environmental resources and amenities. The general principle must be to recognize the environmental cost of these activities, and to incorporate such a recognition in collective and individual behaviour. In part, this latter goal can be accomplished by minimizing physical throughput per unit of economic activity, that is, increasing efficiency of resource use; improving economy of product design; promoting reduction, reuse, recycling, and recovery of wastes, etc.; and reducing the use of particularly noxious substances or activities. However, it will also be necessary to expend considerable efforts in decontaminating and rehabilitating degraded ecosystems, resources, and amenities. All of these responses will require substantial modifications in economic behaviour. To some degree, these modifications can be accomplished through internalization of environmental externalities via mechanisms such as taxes, effluent charges, and social cost pricing, but there are limits to the ability of such approaches to resolve environmental problems.

The economic implications of the principles outlined here are considerable. And they are not straightforward. As pointed out in the Brundtland report, the most negative environmental impacts are most closely connected to the incidence of both great wealth and great poverty. It does not take much imagination to guess on which end of the economic spectrum the burden of increased environmental concern is likely to fall the most heavily. Moreover, many of the links between environmental constraints and institutional or individual implications are very complex. The connections between, say, changed forestry practices, Canada's balance of trade, employment, economic output, inflation, consumer prices, monetary and fiscal policy, etc., are often indirect and counterintuitive. This means that explicit attention will have to be paid to the equity impacts, as well as the economic efficiency, of the required changes (Gardner and Roseland 1989).

Ensuring such efficiency and equity is essentially a political problem. However, there also exist some more direct political issues raised by the need to implement the environmental/ecological principles outlined in the last section. First, it is necessary, as a matter of principle, to ensure that environmental concerns are incorporated directly into political decision-making in a way not typical of past or current practice. This change is likely to require substantial improvements in environmental assessment procedures, the creation of new legal mandates to provide the power required for implementation of sustainability, and perhaps the development of an Environmental Bill of Rights (Elder and Ross 1989).

Second, that sustainability is a normative ethical principle means
that its interpretation in practice is necessarily a political act. This implies a greatly enhanced degree of public involvement in environmental decision-making as sustainability principles, and their application, are debated in the political arena. This is not just a matter of after-the-fact public education and approval. Because the principles themselves are normative, public involvement should occur at the definitional and policy development stages of decision-making.

Third, it is desirable for political activity to be linked more closely to actual environmental experience. This closer link would permit more direct reflection of the causes and consequences of environmental behaviour in political decision-making, allow for the direct expression of individual concern about the environment, and encourage the development and political expression of a relationship to the surrounding environment that can most easily occur at the local level. In practice, this would mean a functional decentralization of some political power to jurisdictions closely linked to natural environmental regions, and the promotion of greater local and regional self-reliance. Such a process has been argued for by proponents of what has been called bioregionalism (Sale 1985).

There are, of course, important limits to such decentralization. Such limits are imposed not only by the need for coordination and consistency of, say, economic activities at the national level but also by environmental imperatives themselves. It will continue to be necessary to develop global, national, and regional responses to many environmental problems. On the other hand, the coordination of political jurisdictions at different spatial levels is a common characteristic of political life. The challenge is to design a set of institutions and rules that permit some functional decentralization of the kind suggested here without compromising the capability of collective responses to environmental concerns at higher political levels.

Sociopolitical Desirability
The preceding discussion provides some principles for collective and individual behaviour compatible with ecological sustainability. By themselves, however, these principles say nothing about the type of sociopolitical system it would be desirable to have, given ecological sustainability. This is important because it would presumably be possible to ensure environmental sustainability in socially undesirable ways (although, as discussed earlier, this would be incompatible with the principle of cultural sustainability). We therefore turn to the question of the sociopolitical realm itself. To do so, we return to the ethical discussion contained in the section on sustainability as a normative ethical principle.

We noted that the self-conscious decision-making and technology-creating capacities of humans have created a cultural evolutionary process that has removed them, to a significant degree, from the determinants of the biological evolutionary process. Such cultural capabilities define the unique character of human potential and the requirements for human expression and fulfilment. They are also the basis of individual moral responsibility. The fulfillment of such potential and the exercise of such responsibility require the opportunity to make meaningful decisions about individual and collective behaviour. Hence, we assert as a principle that the ability of all persons to participate in decision-making about things that affect their lives, the lives of others, and the world around them is a necessary consideration in the design and creation of all sociopolitical structures and institutions.

Meaningful decision-making requires the ability to influence effectively the powers that regulate the interaction of people in a society with each other and with the natural environment around them. Therefore, an open, accessible political process that has effective decision-making power at the level of government closest to the situation and lives of the people affected by a decision is required. Such a process should promote public involvement in decision-making to allow identification and choice of paths of development that are consistent with people's needs, values, and cultural identity.

Responsible participation in decision-making requires freedom from extreme want and from vulnerability to economic coercion, as well as the positive ability to participate creatively and self-directedly in the economic system through which much social interaction and decision-making take place. Moreover, ethical principles suggest the desirability of a minimum level of material equity in society. Thus, all persons should have sufficient wealth and security for themselves and their families to remove them from the possibility of intimidation, exploitation, and coercion of any kind that would inhibit their full participation in political processes.

The ability to engage in good, responsible decision-making requires a minimum level of equality and social justice, including equality of opportunity to realize one's full human potential, adequate material wealth, recourse to an open and just legal system, and freedom from political repression. It also depends on access to high-quality education.
at all age levels, coupled with effective access to information and information distribution systems. Other important characteristics of the principle of access to information include freedom of religion, speech, and assembly.

A basic assumption of this project was that a sustainable society depends ultimately on a sustainable environment. Thus, the amount of the country's wealth that is distributed as material rewards and incentives is limited on the one side by what is created over and above the amount required to maintain the general populace at a reasonable standard of living and by what can be created without taxing the environment and resource base beyond what they can sustain on the other.

**Conclusions**

In this chapter, we have attempted to provide a set of principles in terms of which specific design criteria can be developed that will permit the development and evaluation of scenarios of a sustainable society for Canada. We have articulated a set of general principles of sustainability and a set of more detailed, lower level principles for the environmental/ecological and sociopolitical realms of the project. These principles, summarized in Appendix 3.1 below, are broadly consistent with those found elsewhere in the literature on sustainability issues. When taken together, they define a set of characteristics of a proposed sustainable society for Canada. The next steps in the Sustainable Society Project were to express these principles in the form of scenario design criteria, and to develop and run the scenarios. We turn in the next chapter to a description of how that was done.

**Appendix 3.1**

**Principles of sustainability**

**Basic value principles**

- The continued existence of the natural world is inherently good. The natural world and its component life forms, and its ability to regenerate itself through its own natural evolution, have intrinsic value.
- Cultural sustainability depends on the ability of a society to claim the loyalty of its adherents through the propagation of a set of values that are acceptable to the populace and through the provision of those sociopolitical institutions that make the realization of those values possible.

**Definition of sustainability**

Sustainability is the persistence over an apparently indefinite future of certain necessary and desired characteristics of the sociopolitical system and its natural environment.

**Key characteristics of sustainability**

- Sustainability is a normative ethical principle. It has both necessary and desirable characteristics. There therefore exists no single version of a sustainable system.
- Both environmental/ecological and sociopolitical sustainability are required for a sustainable society.
- We cannot, and do not want to, guarantee persistence of any particular system in perpetuity. We want to preserve the capacity for the system to change. Thus, sustainability is never achieved once and for all, but only approached. It is a process, not a state. It will often be easier to identify unsustainability than sustainability.

**Principles of environmental/ecological sustainability**

- Life-support systems must be protected. This requires the decontamination of air, water, and soil, and a reduction in waste flows.
- Biotic diversity must be protected and enhanced.
- We must maintain or enhance the integrity of ecosystems through the careful management of soils and nutrient cycles, and we must develop and implement rehabilitative measures for badly degraded ecosystems.
- Preventive and adaptive strategies for responding to the threat of global change are needed.

**Principles of sociopolitical sustainability**

(1) Derived from environmental/ecological constraints:

- The physical scale of human activity must be kept below the total carrying capacity of the planetary biosphere.
- We must recognize the environmental costs of human activities and develop methods to minimize energy and material use per unit of economic activity, reduce noxious emissions, and permit the decontamination and rehabilitation of degraded ecosystems.
- Sociopolitical and economic equity must be ensured in the transition to a more sustainable society.
- Environmental concerns need to be incorporated more directly and extensively into the political decision-making process through mechanisms such as improved environmental assessment and an Environmental Bill of Rights.
• There is a need for increased public involvement in the development, interpretation, and implementation of sustainability concepts.
• Political activity must be linked more directly to actual environmental experience through the allocation of political power to more environmentally meaningful jurisdictions, and through the promotion of greater local and regional self-reliance.

(2) Derived from sociopolitical criteria:
• A sustainable society requires an open and accessible political process that puts effective decision-making power at the level of government closest to the situation and the lives of the people affected by a decision.
• All persons should have freedom from extreme want and vulnerability to economic coercion, as well as the positive ability to participate creatively and self-directedly in the political and economic system.
• A minimum level of equality and social justice should exist, including equality of opportunity to realize one's full human potential, recourse to an open and just legal system, freedom from political repression, access to high-quality education, effective access to information, and freedom of religion, speech, and assembly.

Notes
1 For excellent annual reviews of the nature and extent of global and regional environmental problems, see Brown et al. (1995); World Resources Institute (1994); and Clark and Munn (1986).
2 Concern over the nature and extent of such global changes led to the establishment in the 1980s of the International Geosphere-Biosphere Programme on Global Change (IGBP), a collaborative international scientific research program (International Council of Scientific Unions 1987; International Geosphere-Biosphere Programme 1992). The IGBP concerns itself with the natural science side of global changes. More recently, the Human Dimensions of Global Environmental Change Programme was established in order to address the human causes and consequences of global change (International Federation of Institutes of Advanced Study 1989; Human Dimensions of Global Environmental Change Programme 1994).
3 There also exist, of course, criticisms of the concept from what might be called an anti-environmentalist persuasion. Authors such as Simon and Kahn (1984), for example, have argued that there are no environmental problems that cannot be solved through continued development of science and technology in much the same way as they have developed in the past. Such writers see the environmental argument as the real threat to society. These concerns will not be addressed here.
4 On the other hand, the concept of sustainable development has the great merit of forcing a recognition that environmental issues cannot be addressed in isolation from economic and social development issues, especially the problems of poverty, equity, and distributive justice. While we adopt the less loaded term 'sustainability' in this book, we endorse the need to consider economic and social issues, as well as ecological ones.
5 For the purposes of this chapter, the term 'natural world' simply refers to the external biophysical environment within which human beings exist. The line between the natural and the fabricated is notoriously hard to draw, but its precise location is not an important issue here.
6 Of course, the ethical positions outlined earlier have practical sociopolitical consequences in that they constrain the types of sociopolitical behaviour that should be pursued.
7 This is not, of course, to suggest that these schools of thought agree on either the root causes or the appropriate responses to such behaviours, merely that they argue that they are linked.
8 Note that this is a different point than the one made earlier about changes over time. That is, the definition of sustainability provided here implies not only that each definition may be quite different but also that each definition may itself change over time.
9 The term 'sustainable society' was coined by Brown (1981). For a discussion of other uses of the term 'sustainability,' see Brown et al. (1987).
10 Fundamental changes of the type argued for by deep ecologists, for example, are not the sort to be realized in a period of several decades. Students of historical change have noted that the mechanical, Newtonian worldview took several centuries to become dominant in Western society (Butterfield 1957). Ironically, it is precisely this mechanistic worldview that some have described as being at the root of our environmental problems (Berman 1984; Capra 1983).
11 For example, Rees and colleagues have suggested that, because most industrialized countries or regions effectively appropriate the natural capital required to produce the goods and services that they import, the concept of sustainability must necessarily be global. See Rees (1991, 1993).
12 Of course, no social practices have as long lifetimes as those natural processes that change only over geological time. However, such natural processes are relevant to discussions of human behaviour insofar as they can be altered by human activity in the relatively short term.
13 The last year of historical data in the modelling system used in this study is 1981. The scenarios thus start in 1982, and a fifty-year time horizon takes us to the year 2031. Because the scenario analysis was calibrated to real data in 1990, the actual future scenario analysis spanned the forty-one-year period from 1990 to 2031.
14 For a discussion of the measurement problem vis-à-vis the concept of sustainability, see Liverman et al. (1988); Hammond et al. (1995); and Hodge (1996).
15 While Dryzek uses the term 'ecological rationality' rather than 'sustainability,' these terms are not significantly different as they apply to the environmental/eco-
logical terms and in terms of environmental/ecological constraints on sociopolitical behaviour. In order to encompass sustainability in the full sense of the term used here, we would add those characteristics of the sociopolitical realm that are desirable in themselves from the point of view of sociopolitical sustainability, which are described in the following subsection.

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Design Criteria for a Sustainable Canadian Society

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Introduction

The sustainable society values and principles outlined in Chapter 3 are an essential first step in articulating a vision of a sustainable society for Canada. However, they do not provide much guidance about what such a society might look like, or what changes might be required to achieve such a future. It is therefore necessary to try to flesh out those values and principles in the form of more specific descriptions of what they might mean for both the environment and human activities. These more specific descriptions are called here scenario 'design criteria,' because they were used to guide the development and evaluation of the sustainable society scenario described in Chapter 5. Like the principles themselves, they are divided into ecological and sociopolitical categories.

The purpose of this chapter is to outline specific environmental/ecological and sociopolitical design criteria for a sustainable Canadian society. Seeking sustainability means redesigning Canadian society so that human activities do not have long-term undesirable impacts on the environment or the fabric of society. The design criteria described in this chapter are derived from sustainable society objectives based on (1) the definition and principles of sustainability described in Chapter 3, and (2) constraints that are imposed on the definition and these principles by environmental ecological limits, sociopolitical realities, and culture-specific values. The design criteria represent the attempt to apply these constraints to the definition and principles. The approach was not wholly utopian: neither unlimited funds nor a complete reversibility of problems was assumed. Because these design criteria need to have practical relevance, sectors of human activity (such as forestry and fisheries) were examined in relation to both ecological components (such