SUSTAINABILITY

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INTERIOR COLUMBIA BASIN
ECOSYSTEM MANAGEMENT PROJECT

Sustainability

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Introduction

Since the publication of the Brundltand Commission report on the environment and development, paradigms of economic development other than unrestrained capitalistic growth have gained increasing attention. The report argued that sustainable development, in which the needs of the present are met without closing out the options for the future, would be a more appropriate way of resource management, planning and development (WCED 1987).[1] The report's publication, which coincided with and undoubtedly reflected growing global restlessness with the state of the environment, population growth and the distribution of wealth, has become part of an expanding scientific and public debate about how natural resources in thc North America, and particularly the United States, should be managed.* Much of this debate can be traced to increasing scientific awareness that the natural world is a complex, dynamic *system* of species, habitats, landscapes and systems while the dominant paradigm of management has been focused almost entirely on maximizing use or yield of individual species with little attention, or as some would argue concern, about impacts on other species.

Obviously, with hundreds, if not thousands of references, this paper can do little justice as a comprehensive review of the scientific approaches to sustainability (much less the normative and polemical literature) as a concept useful to ecosystem management. The objective, therefore is a narrower and more focused review of recent literature that deals with the conceptual and scientific issues presented by a sustainability paradigm, issues of significance to the Interior Columbia River Basin (ICRB) project More specifically, the objective of this paper is to review and summarize pertinent literature, suggest how sustainability can be used in the ICRB project, and recommend a glossary entry.

Sustainable development, the focus of many discussions of sustainability, is essentially a reformist strategy designed to encourage a type of economic development that more holistically provides for human well-being than traditional approaches (Adams 1990; Barbier 1987; Jacob 1994; Shear-man 1990). While the Brundtland Commission findings were generally greeted positively by a wide variety of audiences, the conceptual, scientific, political and practical challenges to implementing development scenarios that "meet the needs of the present" without compromising the ability of future generations have led to a great deal of debate, particularly among scientists attempting to wrestle with the challenges of a research agenda implied by a sustainability paradigm.

'The actual definition reads "Sustainable development is meeting the needs of the present without compromising the ability of future generations to meet their own needs."

[2]We note that sustainability has long been discussed outside the U.S. context. See for example Paavilainen (1994).

Scientists have attempted to contribute to understanding sustainability through a number of monographs and journal articles focusing on the social basis and history of the sustainability concept (Dixon and Fallon 1989; Stankey and others 1992), the limits of science in the sustainability paradigm (Ludwig and others 1993), definitions of the concept (Bar-bier 1987; Brown and others 1987; Gale and Cordray 1994; Pezzey 1989), and variables and methods to measure the term (Liver-man and others 1988). Other authors have linked sustainability to the concept of ecosystem and ecosystem integrity (Woodley and others 1993) and have suggested it is a primary goal of ecosystem management (Slocombe 1993). Grumbine (1994) has aligned sustainability with ecological integrity. Contrasts with deep ecology have been presented (Jacob 1994).

The scientific and political debate about sustainability is exemplified in an remarkable series of articles published by *Ecological Applications*, a journal of the Ecological Society of America in November 1993. The articles were stimulated by the provocative arguments presented by Ludwig and others (1993) earlier in the year in *Science. These* writers expressed not only their dismay about sustainability as a goal of development, but also the role of science in providing the information and. concepts necessary for achieving sustainability.

Examples of the broadening use of a sustainability paradigm abound, not only in terms of subject matter-tourism (Hill 1992), forestry (Poore nd), range, fisheries, and agriculture (Conway and. Barbier 1990) for example-but also in terms of spatial scales of interest-global, continental, regional, even local. For example Brown and others (1987) define global sustainability as "the indefinite survival of the human species across ail regions of the world." There has also been interest in applying concepts of sustainability to human communities and economic systems, parks and recreation areas, even building materials (see Gormley 1994).

Despite the great interest in sustainability as a concept of economic development, and ecosystem management, a consensus on its definition remains elusive-a conclusion Liverman and others (1988) argued six years ago when they stated "there seems to be little clarity in the definition of sustainability." This contusion may relate to the conventional wisdom that sustainability is a biophysical concept when it is fundamentally social in purpose and function, involves choices about how we manage not only our forests, but our lives as well, and requires for its implementation the conscious awareness of social and biophysical consequences.

Some Basics

Shearman (1990) maintains that there are two kinds of definitions of sustainability: a lexical one (which follows immediately) and an implicative one. Lexical definitions are found in dictionaries. There are at least three lexical uses of the sustainability concept: as a verb, an adjective and noun. Because of the different grammatical functions of each term, definitions vary but do focus on similar meanings. Webster's New World Dictionary defines "sustain" as to keep going, prolong, maintain. As such., sustain is a verb and is commonly used in the sense of "to sustain ecosystems." Sustainable (an adjective) is defined as "capable of prolonging, maintainable". Sustainable is generally used to modify such terms as use, growth and development, but has also been used in the context of "sustainable ecosystems." Sustainability is a noun, but is not listed in the dictionary. The term sustainability appears to be used as a goal or as deVries stated as "something to be declared"' While the grammatical function of these terms vary, we can assume the goal of their uses is similar, a conclusion also presented by Shearman (1990) when he noted that "there can be no debate" about their lexical meaning.

An implicative meaning of a term "refers to the significance of something" (Shearman 1990). Since there is "no debate" about the lexical meaning of sustainability (and its related use as a verb or adjective), the discussion about sustainability is focused primarily on its implicative meanings, which are derived principally from context and use. Shear-man goes so far as to argue that the meaning of sustainability is not "an item for further discussion. What should be discussed are the implications of sustainability when it is applied as a modifier in a particular context." This paper will identify some of those implications but focus principally on issues raised by its use as a reformist strategy in the Columbia Basin.

Some Definitions

To date, dozens of definitions of sustainability have been proposed, with Pezzey identifying 27 as early as 1989. Lubchenko and others (199 1), in presenting an ecological research agenda, define sustainability as "management practices that will not degrade the exploited system or any adjacent systems." Most recently, Gale and Cordray (1994) have suggested nine different answers to the question "What should be sustained?"[4] Table 1 lists some of the answers to the question posed by Gale and Cordray. Many of the definitions proposed in the literature are specific to individual resources (such as forests or fisheries), and thus, may not be useful from an ecosystem perspective.

Sustainability is used in several contexts, primarily in economic, social and ecological ones. Brown and others (1987) present a social definition as being the "continued satisfaction of basic human needs-food, water, shelter-as well as higher-level social and cultural necessities such as security, freedom, education, employment, and recreation." Their ecological definition suggests "continued productivity and functioning of ecosystems." An economic definition was not provided because "economists tend to assume the inevitability of economic growth and do not, for the most part, address the issue of sustainability." The latter is an interesting conclusion because (1) the term *sustainable economic development* has a history in the international literature, and (2) by their implication, growth and sustainability are mutually exclusive.[5]

As noted above, individual areas of resource and economic development have identified and developed definitions of sustainability, or have used the concept to modify terms describing current management topics as in sustainable forestry, sustainable fisheries, sustainable agriculture and sustainable tourism The objective of these uses of the concept appears to be to distinguish current and

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'Cited by Gormley, 1994.

[4]The volatility of the sustainability discussion is exemplified in two articles produced by Gale and Cordray (1991; 1994). In the former, eight answers to the question of what should be sustained were identified, by 1994 nine answers were proposed with some of the answers different from the earlier paper.

[5]In addition, economists debate whether sustainable economic development is a no-growth policy.

dominant paradigms of resource management from something else, although the clarity with which that something else is communicated often leaves much to be desired. Jensen and Bourgeron (1993) defmed sustainability in an ecosystem context as "the ability to sustain diversity, productivity, resilience to stress, health, renewability, and/or yields of desired values, resources, products, or services from an ecosystem while maintaining the integrity of the ecosystem over time."

Many discussions of sustainability go beyond maintenance of ecological systems and integrity and mere biological survival of the human species. Definitions frequently imply or explicitly include a quality of life dimension. For example, Brown and others (1987) refer to the "social and cultural perspectives on what is needed for a quality existence". These authors also include "small-scale and self-reliance" as a theme in definitions of sustainability. Barbier (1987) notes that sustainable economic development means the total development of society, increases in material means of living to the poor, ensuring the long-term potential for economic activity, and is primarily qualitative in nature. He argues that the goal of sustainable economic development is to maximize the goals of the biological, economic and social systems "through an adaptive process of trade-offs". The notion of including quality of life aspects in sustainability is also reflected in the most recent international statement, which is the cornerstone for global conservation strategies, "*Caring for the Earth:* A *Strategy for Sustainable Living*" (IUCN 199 1). This declaration defines sustainability as "improving the quality of human life while living within the carrying capacity of supporting ecosystems."

Others have attempted to be more specific in articulating the concept. For example, sustainability has been posed as equity in distribution of income between generations. Essentially, this means that the present generation may relinquish some income for future generations. Or, sustainability may be defined as maintaining resource uses such that options for the future are not foregone, the basis of the Brundtland Commission definition (see Table 2 for a list of conditions that will lead to sustainability as defined by the Commission). Veeman (199 1) argues that sustainable development includes growth, distribution and environmental components, and claims that the concept does not imply a "no growth" position.[6] A more equitable distribution of income among the current population has also been identified as a measure of sustainability (Brown 1989). And, physical and social limits to growth are sometimes mentioned as factors in defining sustainability (Pirages 1977). Iverson and Comett (1994) defme sustainability as "a relationship between [sic] dynamic cultural, economic, and biophysical systems across the landscape such that quality of life for humans continues ..."

As Liver-man and others (1988) note, indicators of sustainability have been difficult to develop and apply on a global or national level. To some extent, this problem is a result of the vagueness and multidimensionality of the concept; otherwise, they state it is a matter of data availability, an argument difficult for these authors to accept. However, the question of scale at which sustainability should be measured is an essential issue to which we return later.

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[6]As discussed later. Costanza and Daly differentiate between growth and development, and argue that sustainability may imply no or limited growth but development.

The review of the concept of sustainability by Brown and others (1987) concluded with the question "Is global sustainability merely a utopian ideal, or is it actually something which is achievable?" Their definition of a sustainable world as "one in which humans can survive without jeopardizing the continued survival of future generations of humans in a healthy environment . . ." implies that it is more the former than the latter.

Issues

There are several major questions associated with sustainability relevant to the Interior Columbia Basin project. It would seem that these issues be addressed as part of the process to define sustainability. First, is sustainability a moral or scientific choice? Second, what should be sustained? Third, what are the barriers to achieving sustainability? Fourth, how does scale interact with the concept? A final issue is the one of uncertainty.

Is sustainability a moral or scientific decision?

The literature is fairly clear that sustainability is a goal. Iverson and Cornett(1994) present an alternative viewpoint in which sustainability is viewed as more of a process (subject to a constraint) than something to be attained. The varieties of things that can be sustained confront societies with difficult choices for which there are no intrinsic, scientifically based criteria for choosing. Science can play an indispensable role in identifying and describing the consequences of alternative development and sustainability scenarios, yet in no way can it dictate solutions or directions. Given Gale and Cordray's nine answers to what should be sustained or Jensen and Bourgeron's inclusive definition, there appears to be no innate scientific reason for selecting one answer or thing to be sustained over another. Thus, sustainability, as a goal, is a value judgement.

The different choices (see below) about sustainability raise a number of questions about the consequences to society as well as the natural world. Who makes the choices? Who are the beneficiaries? Who pays the costs? Not only is it a judgement that sustainability should be pursued (versus some other goal) but what should be sustained is a decision that can be addressed only within a social-political or moral context. Shearman (1990) notes that "the underlying assumption within ecologically sustainable development is that sustainability is desirable."

What should be sustained?

While many definitions of sustainability refer to individual species or biological communities, the question of what should be sustained is an important one for the ICRB project. When referring to sustainability, is our discussion limited to the biophysical components of basin ecosystems, or is it a more inclusive reference to *the ecosystem as* defined by *the Scientific Framework?*[1] More specifically, should sustainability be limited to biophysical systems under the management of the Forest Service and Bureau of Land Managemenf assuming that if these systems are maintained,

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[1]The Scientific Framework for Ecosystem Management in the Interior Columbia River Basin (1994) defines ecosystem such that it includes both social and biophysical components.

dependent social and economic systems are maintained as well? This deftition would seem to be overly narrow and would likely be criticized on both scientific and social grounds.

Gale and Cordray (1994) offer us at least nine choices as shown in Table 1. While these choices are not exhaustive,* neither are they necessarily mutually exclusive. Yet, the decision of what to sustain will remain a normative. one, that is a value judgement. Adams (1990) would argue that this is an ethical question. Addressing the question of what will be sustained in the basin the function of the term in the ICRB process.

At what scale is sustainability measured?

Scale is an important, though often neglected component of sustainability discussions. Lee (1993a) notes that mismatches between human and biological scales lead to unsustainable resource uses. There are two, perhaps three, scale types that are relevant here. First, there is the issue of temporal scale: over what period of time do we judge the sustainabihty of resource management? Part of this issue concerns our ability to measure and learn from the long term effects of resource management actions: Lee (1993a) argues that since the world is rich in natural patches, unsustainable uses can continue for long enough that humans will feel the use is permanent

Many authors will speak to sustainability as a means of achieving intergenerational equity, that is, income today is forgone for income due to future generations. At the same time, we note that sustainability often includes reference to intragenerational equity, that is, a more balanced distribution of income among members of the current generation.[9] There may be conflicts between resource management that aims for intergenerational equity and management that is directed toward intragenerational equity (Dovers and Handmer 1993). Toman (1994) notes that intergenerational equity is one of two main salient issues concerning sustainability. His other main issue is the nature of the "social capital" to be left to future generations. Dixon and Fallon (1989) state that "the shorter the time horizon [in resource decisions], the less likely any pattern of resource use will be sustainable over long periods of time." Mismatches between temporal scales leads to one generation bearing the costs of another generation's benefits. Mismatches may also lead to replacement of one ecosystem developmental pathway with another such that options in the future are limited.

A second type of scale is spatial: over what spatial scale is sustainability measured? Mismatches between spatial scales can lead to some people or ecosystems bearing costs without any associated benefits. Brown and others (1987) and Livermore and others (1988) direct their attention to sustainability at the global scale. In terms of the ICRB, however, sustainability must refer to a spatial scale less than global if it is to have any pragmatic utility. One international meeting (Second Ministerial Conference on the Protection of Forests in Europe) constrains its deftition of

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[8]It would seem that many of our publics are keenly interested in the sustainability of their communities and lifestyles, an answer surprisingly neglected by sociologists Gale and Cordray.

[9]In terms of international aspects, this often leads to a debate about consumption patterns between the north (or developed nations) and the south (or "third world countries).

sustainability to actions that do not cause damage to other ecosystems.” Since multiple spatial scales” are involved, situations in which resource management is sustainable at one scale but not at another will arise. For example, sustainable development at the local scale may be viewed as leading to unsustainable development patterns at a national level (Dixon and Fallon 1989). Conversely, resource management at the patch level may be unsustainable but at the landscape or watershed levels may be sustainable. Likewise, actions leading to sustaining ecosystem productivity (in the Jensen and Bourgeron sense) could lead to loss of sustainability at other scales to some ecosystem services. Processes to resolve conflicts in sustainability at different spatial scales will need to be developed.

Lee (1993a) argues that a third scale mismatch occurs, what he terms a functional scale mismatch, founded on the principle that natural systems are complex but human actions and guiding institutions are necessarily specialized The achievement of specialized goals may conflict functionally with sustainability of ecosystems. He uses the example of water appropriations by right of prior use, and how government institutions continue to function to adjudicate water rights by these traditions even though an argument could be put forth that they are now obsolete. Such an obsolete institution “abets poor resource allocation.” Another example may be silvicultural systems that encourage a dominant single species because of desirable fiber characteristics when that species characteristically is only a small component of the biomass of a forest Such single species management is at odds with the multiplicity and complexity of values and services a natural ecosystem provides. Another example may be actions that sustain biodiversity may negatively impact other values of ecosystems.

What are the barriers to achieving sustainability?

There are three principal barriers to achieving sustainability. The first may be termed paradigmatic; the second, social; the third, knowledge. Each barrier will be briefly summarized.

The Paradigmatic Barrier

The literature suggests increasing dissatisfaction with the idea that sustainability can be achieved through existing and dominant societal paradigms. For example, Jacob (1994) indicates that sustainable development (in the Brundtiand Report context) “retains the Western tradition’s assumptions that humans have a privileged role in the biosphere” while the followers of Deep Ecology would question whether sustainability can be achieved in a Western society where nature is viewed as having value for human purposes and no intrinsic worth itself. Robinson (1993) has critized sustainable development (in the Caring for the Earth context) as being “simplistic” and containing an almost exclusive focus on human beings. Adams (1990) suggests that “ecocentric” approaches to

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[10]The definition reads “Sustainable management means the stewardship and use of forests and forest lands in such a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and *that does not cause damage to* other *ecosystem* ”(Paavilainen 1994; emphasis added).

“We would also argue that multiple social organizational scales are also involved, an issue rarely addressed the sustainability literature reviewed here.

sustainability "demand fundamental change in political economic structures" and are not simply about reforming resource management policy.

The Social Barrier

The social barrier consists of a variety of institutional, cultural and economic obstacles that are increasingly discussed in the literature. Clark (1990) identified three principal economic barriers to achieving sustainability: (1) common ownership of resource stocks, (3) the discount rate employed in valuing present and future flows of income; and (3) uncertainty and its effects on management strategies and consumption patterns. The first barrier is commonly known as the "tragedy of the commons", where individuals acting perfectly rationally end up with a socially undesirable outcome. The second barrier reflects the relative values individuals and institutions place on the present *vis-a-vis* the future. To a great extent sustainability may be viewed as an attempt to lower the discount rate. The third barrier reflects our lack of knowledge of natural processes and systems and the impact of people on them. Getting people to change behaviors in light of uncertainty is, as Clark notes, "difficult."

Costanza and Daly (1992) suggest that discussions about sustainability can be enhanced by differentiating between development and growth. Growth involves increased throughput while development is an increase in efficiency. They argue that there are "clear economic limits to growth but not to development", although there may be limits to development (but they are not clear). Thus, sustainability, from an economic perspective, should focus on increasing efficiency of current utilization of natural resources and providing incentives or disincentives to growth.

Institutional barriers involve how governments have intervened to protect natural resources from exploitation and the appropriateness of those interventions within a systems and sustainability context. Current institutions that deal with natural resources management engage in what Lee (1993b) has termed cybernetic learning, and thus decision-making: "Facing a complex world, the decision maker seeks not the best outcome among competing objectives, but instead a satisfactory result on each goal, taking goals *one at a time*. Thus, instead of solving a set of linked problems within a coherent strategy, the decision maker monitors a few critical variables and tries [to] keep the system within the bounds defined by the limiting values of those variables" (emphasis in original). The problem, Lee later notes, is not that the law or institutions are followed correctly, but in the nature of the institutions themselves; many current institutions are inappropriate for the complex problems of ecosystem management- Lee then strongly advocates adaptive management and learning as ways of dealing with institutional obstacles to system management.

Finally, scientists and institutions prefer avoiding Type I errors (claiming something is true when it is false) in decision-making over Type II errors (claiming a finding is false when it is true), a preference that should be challenged according to Lee (1993b). In the situation of sustaining ecosystems, Type I errors occur when agencies presume their actions have little impact on the environment and are therefore implemented when they ultimately result in some effect. Since many systemic effects may not be observed for years after a management action (e.g. fire prevention in some ecosystems), one should carefully identify the costs of both Type I and Type II errors in when proposing actions to achieve sustainability.

Cultural barriers deal with a wide variety of beliefs and values held by various publics with respect to natural resources specifically and consumption patterns more generally. Salwassar (1990) expressed concern about cultural issues when he asked "Are there cultural or religious impediments to a land ethic? Or do biologists just confront an educational challenge?" Jacob's (1994) review of Deep Ecology and sustainable development would suggest that there are significant cultural impediments. Shearman (1990) argues that an ethical perspective is important in addressing sustainability. Sustainabihty, if not a moral decision, is certainly one that demands reflection of values: "The underlying characteristic of all such [ecologically sustainable development] strategies, however, is that development is ethically good; it is a value laden process seeking to make life better than it is at present"

The Knowledge Barrier

The knowledge barrier deals with the knowledge required to achieve sustainability. Ludwig and others (1993) reflected a pessimistic view of the role of science in achieving sustainability when they indicated that (1) scientific understanding is hampered by the lack of replicates and controls, (2) the complexity of the biophysical world precludes a reductionistic approach to management, and (3) large amounts of natural variability in systems under study mask effects of exploitation. This all means that science may not be able to help managers reduce the uncertainty confronting them when making decisions about natural resources. While their critique of the usefulness of ecological research appeared to be somewhat harsh to some (see Holling 1993 for example), most can agree that our knowledge of ecosystems is limited

Not only is our knowledge of ecosystems limited, scientists have tended to exclude cultural and political dimensions of ecosystems from research agendas. For example, Ludwig (1993) notes that the Strategic Biological Initiative developed for increasing understanding of sustainability does not include any items relating to human population dynamics or systems of resource use. Similarly, Grumbine (1994) finds no research function in ecosystem management for social scientists. While this barrier can be overcome, additional biophysical research may be viewed only as a necessary but not sufficient condition for sustainability.

Compounding this barrier is the preference among scientists to exclude informal ways of knowing. The argument goes that only through formal, scientifically defensible research can we learn about the natural world In a recent book about planning, Freidmann (1987) develops a position questioning the implied superiority of formal means of knowing. He asks "On what grounds can scientific and technical knowledge, with its presumptive universal validity, claim to be superior to personal knowledge, especially when the application of each kind of knowledge yields a different result?"

Uncertainty and Sustainability

The issue of uncertainty is derived from the knowledge barrier briefly discussed above. Ludwig and others (1993) admonish that we must "confront" uncertainty, rely *on* decision theory, and not be too concerned about theoretical "niceties." We will never have perfect knowledge of how the natural world operates, yet we need to continue to make decisions that will lead to sustainability.

Surprises will occur, and it is how we organize to deal with those surprises that reflects our understanding of social and biophysical aspects of ecosystem sustainability (Lee 1993b). The level of uncertainty seems to be exploding in the face of increasing knowledge as industrial development leads to ever-increasingly complex and insidius effects of decisions. Making decisions in the face of knowledge that one may not understand effects on sustainability will require some level of "arrogance" (Dover-s and Handmer 1993). Given uncertainty, Lee (1993a) argues that our obligation is to learn and hold ecosystem managers to a standard of improved understanding and decisions commensurate with the best available information.

The literature frequently confuses risk (consequences can be stated with a known probability) and uncertainty (where we may be aware of the consequences but we cannot state the probabilities) when referring to problems of ecosystem sustainability and decision-making (Costanza 1993). Decision strategies will be different under each situation. In addressing decision-making, Clark (1990) indicates several potential strategies, the appropriateness of each depending on whether risk or uncertainty is involved: (1) play safe; (2) wait; (3) laissez faire; or (4) armegeddon. The implications for sustainability are that we must have a better understanding of how actions or failures to act lead to certain consequences and how those consequences affect our drive toward sustainability. Through learning and adaptive management, we may be able to move toward situations of risk, but such learning should be over scales of biological significance (Lee 1993b).

A Proposed Definition and Use in the Interior Columbia River Basin Project

The preceding discussion was deliberately designed to be extensive not only to do justice to the concept and the literature that has developed, but also to display the complexity and diversity of issues associated with definitions and applications. Given the wide variety of definitions and issues associated with the concept of sustainability, there is a real question about the desirability of pursuing definitional eloquence and utility in the ICRB process. Shearman (1990) would argue that what we need to develop is more in the way of a framework than a definition, we should spend our resources developing processes for "getting there." A framework might address the following:

(1) the issue of scale, in both a temporal and spatial sense;
(2) implications for measurement;
(3) what will be sustained;
(4) defines the concept at the systems level, rather than being directed toward a specific kind of biological or social entity;
(5) states sustainability as a goal.

Given the above, the following is a recommended glossary entry for the ICRB:

> **Sustainability. A situation where resource management options are designed to meet the needs of the present without compromising the ability of future generations to meet their own needs**
>
> [NOTE: WE HAVE SELECTED THIS DEFINITION BECAUSE IT IS MOST WIDELY USED IN THE LITERATURE (BASED ON THE WCED REPORT) AND SEEMS TO

HAVE SOME DEGREE OF FOLLOWING. THIS DEFINITION IS NOT THE BEST, BUT IT MAY BE NO WORSE THAN ANY OTHERS. THE SIT MIGHT WANT TO CONSIDER THE TYPES OF THINGS SUSTAINABILITY LEADS TO, A FRAMEWORK FOR SUSTAINABLE MANAGEMENT OF DECISIONS, IN A SENSE A SORT OF THE WCED APPROACH.]

Table 1. Nine answers to the question "What should be sustained?" (adapted from Gale and Cordray 1994)

Type	**What is sustained**
Dominant Product	Yield of high-valued products
Dependent social systems	Communities, families, occupations
Human benefit	Diverse human benefits
Global niche	Globally unique ecological systems
Global product	Globally important high-value products
Ecosystem identity	General types of ecosystems or resource uses
Ecosystem insurance	Ecosystem diversity
Ecosystem benefit	Undisturbed ecosystems
Self-sufficient	Ecosystem integrity

Table 2. Objectives of sustainable development (WCED 1987)

1. Reviving growth
2. Changing the quality of growth
3. Meeting essential needs for jobs, energy, water and sanitation
4. Ensuring a sustainable level of population
5. Conserving and enhancing the resource base
6. Reorienting technology and managing risk
7. Merging environment and economics in decision making
8. Reorienting international economic relations
9. Making development more participatory

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