

Part 1

Conceptualizing Sustainability

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The livelihoods of a majority of the global population depend directly upon products derived from natural resources; and everyone, as consumers of food, depends indirectly upon natural resources. The former include farmers, for whom the primary goal during eight millennia of exploitation of natural resources has been ensuring adequate supplies of food for their families. With the rapid growth of towns and cities, these farmers have also to produce surpluses to feed urban families as well.

Despite the recent success in expanding global food supply—today's population of 5.8 billion have, on average, 15 percent more food per capita than the global population of 4 billion had two decades ago (FAO 1996)—shamefully, more than 800 million are still chronically hungry, mostly living in rural areas. Moreover, reports of civil unrest caused by shortages of food or high prices are all too frequent. Thus, the International Commission on Peace and Food in their report *Uncommon Opportunities* note that "food has become a symbol of our collective human endeavor to create a better world for all" (Swaminathan 1994).

Food production depends ultimately on sound and productive natural resource systems. The per capita availability of land and water for agriculture is limited and declining as a consequence of increasing population, degradation and redirection of land and water to domestic and industrial uses. Moreover, significant environmental costs have been associated with the past successful agricultural growth (Brown and Kane 1994), such as salinization, soil erosion, lowering water tables, and loss of biodiversity.

Apart from food, natural resource systems also provide other essential services for mankind. Agriculture produces raw materials for industry, such as fibers, oils, and starches; and forests provide products for construction, medicines, and recreation. Further, the sound management of watersheds is assuming growing importance as fresh water supplies become increasingly scarce.

Thus, the access to natural resources, and their condition and productivity, are critical concerns. The use and management of these natural resources, whether private or communal, is changing as populations grow and migrate, as new technologies are developed, as domestic policies are adjusted, and trade volume expands and patterns change. With the adjustments in policies and trade, the terms of trade in the natural resource sector are also changing. Natural resource managers, of whom a majority are farmers, make production and consumption decisions within the context of, inter alia, market prices for natural resource products. One key category of household decisions concerns investment for the enhancement of natural resources, in order to secure (increased) future productivity.

Sustainable development has become part of the lexicon of many governments, nongovernment organizations, and international agencies, especially since the popularization of the term by the United Nations Conference for Environment and Development held in 1992 in Rio de Janeiro. The essence of sustainability is intertemporal continuity and equity; thus, the dynamics of resource use lie at the heart of the conceptualization and measurement of sustainability.

Sustainability can be interpreted as both a system characteristic and a decision objective (see Dixon this volume). Some definitions highlight the multidimensional nature of sustainability (see, for example, FAO 1989), although they do not lend to quantification or the direct development of indices.

Others are analytical (see, for example, Pearce, Barbier, and Markandya 1990), which beg the question as to the specific elements which should be introduced into "the vector of development characteristics." Relevant development characteristics can be defined at the multiple levels of natural resource systems (e.g., plots, households, communities, watersheds, nations). At the plot level, soil fertility, deforestation, yields, and other biophysical parameters are often important. The farm-household determines the allocation and use of privately owned natural resources. Often, the community influences the allocation and use of certain natural resources, which approximately coincide with a microwatershed in some landscapes. The sectoral and national institutions establish the policy environment within which farmers manage natural resources.

Despite a voluminous literature related to the concepts of sustainability, strategies and policies for sustainable development, and the study of sustainable development, the experience with the measurement of sustainability, both directly by estimation and indirectly through indicators, is limited especially at the village level. The papers in this part of the volume discuss various approaches to sustainable development and the implications for improved natural resource management.

The first paper is the keynote address given by Nancy and George Axinn at the conference on "Participation, People, and Sustainable Development" held in March 1996 in Rampur, Nepal. In "The Human Dynamics of Natural Resource Systems," they paint a picture of global change in light of development efforts of the last two decades and then focus on key issues that have to be addressed. They distill their experience of local development efforts to take a look at some of the main issues of concern that are the consequences of "the ability of this generation to exploit our ecosystem more rapidly than our predecessors." While the Axinns observe that there is rising ethnic conflict, wealth disparity, population growth, neglect and abuse of women and the young, and so on, they also see a distinct "potential within people to address their own problems and work out new and better solutions."

The authors then discuss the impact of twentieth-century agricultural practices on the natural resource base to argue for a systems approach to organized, positive change in rural areas, since "everything is connected to everything else." Their review of a systems approach illustrates some alternatives to the so-called decentralized approach to participation and includes a treatment of delivery and acquisition systems. In their discussion of the "human" aspects of natural resource systems, the authors consider issues that they see as particularly important for the planning, organization, and management of natural resource systems into the next century. These are sustainability, participation, decentralization, gender considerations, accountability, collaboration, and human greed and corruption. The Axinns see the most serious issue as "sustainability of Earth as a planet where humanity may survive over the generations." For them, sustainability is related to participation because "it is increasingly clear that change without participation of those most affected by the change is not likely to be viewed as development, and not likely to be sustainable."

The Axinns point out that the gender issue pervades all aspects of rural development activity, and that ignoring this issue is a "major strategic error" in mainstream development practice today. They also point to two other issues crucial to all types of development activities: "client accountability" and "genuine collaboration." They warn that development efforts by governments or NGOs that lack mechanisms of accountability to beneficiaries are less likely to be useful. For accountability to be an essential part of development activity, the Axinns argue, a spirit of genuine collaboration must prevail, where outsiders take time and effort to learn from and share with farm men and women.

In concluding their presentation, the Axinns address the issue of human greed and corruption which is symptomatic of unbridled self-interest and is present in every nation. Greed and corruption—by the powerful—erect numerous obstacles to the social and economic empowerment of common people and pose problems for sustainable development. This issue and each of the issues touched upon, Nancy and George Axinn argue, must be addressed to gain a better understanding of the dynamics of natural resource systems.

Information and knowledge play critical roles in the management of natural resources and the functioning of institutions at all levels. Whilst two decades ago most natural resource planning and project formulation was based on scientific knowledge, there is now widespread acceptance of the worth of indigenous knowledge. Extremes, of course, are rarely optimal, and the one productive line of inquiry is the blending of the best of indigenous and scientific knowledge (Alders et al. 1993). In the second paper, Professor John Erskine discusses the place of traditional knowledge and practices in sustainable development.

Professor Erskine begins by defining sustainability as a relationship between "dynamic human economic ecosystems" in which there is continuity and flourishing of human life and where human culture can develop without destroying the diversity, complexity, and function of ecological life support systems. Erskine uses the example of less developed, rural areas in South Africa to argue that to achieve sustainability, it is necessary to improve local opportunities for enterprise, wealth, and job creation by helping people attain self-reliance through self-generated and self-sustaining economic and social development.

The paper then argues that all three components of sustainable development—social, physical, and economic—must be given due attention. Based on several studies conducted in a number of countries in Africa, Asia, and South America, the paper identifies the most important determinants of the sustainable use of natural resources in less developed communities as the unsustainability of local institutions responsible for the allocation and use of communal lands, and the unsustainability of many traditional practices and attitudes or beliefs. Erskine identifies indicators of sustainability important to know for both resource use planners and resource users without consideration of which the value of diversification, local resource generation, recycling, and the rationale of traditional systems of rationing, and so on, all central to sustainable development, will be disregarded and, thus, miss the essence of food security.

In discussing the influence of demographic characteristics on the use and condition of natural resources, Erskine argues that characteristics, such as being modern or traditional, influence the use of natural resources. The paper further argues that if people aspire to escape from poverty and enjoy higher living standards, they "must be prepared to discard outdated traditional practices and beliefs that no longer fulfill the function that they were conceived for originally."

Finally, Erskine lays out the means to implement sustainable natural resource and land use systems: community stake holders must have (1) strong local organization, (2) real powers and rights, (3) necessary knowledge and capacities, (4) an economic interest, and (5) a desire to play a responsible role. The paper concludes by reiterating two of the vital ingredients for success in achieving sustainable use of natural resources in less developed areas. These are (a) the involvement of local people through appropriate institutional development in the design and management of suitable environmental management systems and (b) the voluntary abandonment by local people of outdated traditional practices and beliefs, in response to information dissemination and appropriate incentives.

In "Irrigation as Technology, Irrigation as Resource: Hill Irrigation and Natural Resource Systems," Linden Vincent critiques four different frameworks of study of resource use to evaluate their particular strengths and weaknesses in informing the sustainable development debate. Professor Vincent contends that "a new platform of action is possible on natural resource management" but that, "to work, it must encompass the different ideologies currently present in research on resource management."

She uses her experience in irrigation studies to examine natural resource management in each of the following frameworks: the natural resource system perspective, the societal resource system perspective, the farming system perspective, and the sociotechnical system perspective. Vincent points out the strengths and weaknesses of each perspective and, in doing so, draws lessons for the sustainable development debate.

Professor Vincent defines a natural resource system as "a cycle of socially useful natural

phenomena and the sociotechnical complexes within it, which modify this cycle of livelihoods, and are also shaped by it." From the perspective of irrigation as a natural resource system, what is important to know is that successful irrigation organizations share certain characteristics; property rights play an essential role in shaping water management institutions; farmers' water management practices depend on economic, social, and technical factors; farmers make decisions under uncertainty based on the operational aspects of local technology; poor reference of technology weakens analysis of environmental dynamics; and tolerance of different research methodologies assists new platforms of inquiry.

When irrigation is examined as a societal resource system, the author observes that there is overtly political contestation and struggle for resources; there is necessity for provision of special platforms for negotiations over resource use; and that government agencies are part of the problem for sustainable development although nongovernment organizations can help mediate water allocation and use issues. However, Vincent cautions, overemphasis on social relationships can reduce understanding of technology and agroecology.

By examining irrigation both as a farming system and an agricultural system, Professor Vincent makes the following important observations: agroecosystems and natural systems are dynamic; farmers have complex livelihood strategies; resource use is affected by conditions of livelihood security and poverty; the division between technology and resource orientations weakens contributions to the sustainable development debate; and indigenous knowledge versus western science debates and biases confuse research and development.

Finally, Vincent presents irrigation systems as sociotechnical complexes within a water resource system. When irrigation is viewed as a sociotechnical system, some important issues that have to be considered are: practical management capabilities; technological constraints; adaptation of irrigation technologies; insights for change based on farmers' actions; understanding of design histories; communication between engineers and farmers; and integration of system level operations and field water management needs. In concluding, Professor Vincent calls for the recognition of irrigation as both technology and resource and supports the creation of a "resource-technology system" perspective that would enable a platform to promote sustainable irrigation and water resource development in the future.

Thus, the contributors in this part of the volume on *People and Participation in Sustainable Development* provide a succinct look at the debate on "sustainable" development and introduce the reader to the issue of participation in light of the dynamism inherent in human populations and in natural resources.

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