Environmental Planning, Ecosystem Science, and Ecosystem Approaches for Integrating Environment and Development

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ABSTRACT / Currently popular concepts such as sustainable development and sustainability seek the integration of environment and development planning. However, there is little evidence that this integration is occurring in either mainstream development planning or environmental planning. This is a function of the history, philosophies, and evolved roles of both. A brief review of the experience and results of mainstream planning, environmental planning, and ecosystem science suggests there is much in past scientific and professional practice that is relevant to the goal of integrated planning for environment and development, but still such commonly recommended reforms as systems and multidisciplinary approaches, institutional integration, and participatory, goal-oriented processes are rarely achieved. "Ecosystem approaches," as developed and applied in ecology, human ecology, environmental planning, anthropology, psychology, and other disciplines, may provide a more transdisciplinary route to successful integration of environment and development. Experience with ecosystem approaches is reviewed, their advantages and disadvantages are discussed, and they are compared to traditional urban and regional planning, environmental planning, and ecosystem science approaches. Ultimately a synthesis of desirable characteristics for a framework to integrate environment and development planning is presented as a guide for future work and a criterion for evaluating existing programs.

Urban and regional planning has a long history of describing and seeking to improve human surroundings. In recent decades environmental planning has emerged specifically to protect and enhance the natural surroundings of people and their societies. The expansion of planning interest from human-created and modified environments to the natural environment, from peoples' immediate surroundings to the entire biosphere, has been necessitated by the expansion of human activities themselves. Human development activities now extend to and affect the entire globe. Environment and development can no longer be approached separately, as the concepts of sustainable development and sustainability have implied since the early 1970s and the United Nations Conference on the Human Environment (see the statements in UNEP 1981). A sustainable society would be one in which resources and environment are used and managed so that they not only meet current societal needs, but also will continue to do so in the future. This is a complex task with ecological, social, economic, and other implications. Thus research and policy are increasingly seeking to elaborate in detail the complex linkages between ecological systems, economic needs and activities, and sociocultural needs and processes (e.g., IUCN/UNEP/WWF 1991, Stern and others 1992).

KEY WORDS: Ecosystems; Ecosystem approach; Sustainable development; Regional planning; Environmental planning; Human ecology

Development itself is increasingly defined in social and environmental terms, as for example "to enlarge the range of people's choices, . . . including access to income and employment opportunities, education and health, and a clean and safe physical environment" (World Bank 1991). Yet planning for development remains largely the work of economists and mainstream urban and regional planners, while planning for the biophysical environment remains the separate work of environmentalists, ecologists, and resource managers of various kinds. This is so in spite of the fact that it is at the regional and local level—the level of traditional planning activity—that conflicts between environmental conservation and development planning become most apparent (see the case studies in Crowfoot and Wondolleck 1990, Lang 1986). Making specific choices about land use, wildlife protection, and resource development that are acceptable to entire communities and regions, and that are sustainable, may be the hardest task we face in the

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coming decades. There can be little question that planning, and planning frameworks, which fully integrate environmental planning and development planning, would improve this situation.

Linked to this are new ways of conceptualizing the context for discussions of the interactions of environment and development. The term environment has been broadened to include socioeconomic dimensions as well as biophysical, through experience in impact assessment and planning, but there is no widely accepted term for the overall, regional-scale, biophysical and socioeconomic system that is the context for achieving sustainable development. Some generalize "ecosystem" to this scale, others have suggested bioregion (e.g., Sale 1985) or sociobiophysical system (Slocombe 1990). For consistency with much of the literature referred to, the term "ecosystem" is used in this article, and this usage is discussed more fully later. For clarity I occasionally use such modifiers as "local" and "regional" to make clear the scale of ecosystem I am referring to.

Mainstream urban and regional planning focuses on communities and their people, land use, economies, and infrastructure, through a process of goal-setting, planning, and regulation. Environmental planning focuses on the biophysical environment of people and communities and on the effects of other planning and development activities. It is more descriptive and science-based than mainstream planning. This article can not be a comprehensive survey of either the history and methods of mainstream urban and regional planning or environmental planning. Weaver (1984) and Gilpin (1986), respectively, provide relevant discussions. Both kinds of planning can learn from the other: urban and regional planning has (largely forgotten) roots in holistic, ecosystem approaches, and environmental planning could benefit from the long, systematic, procedural experience of mainstream planning. Building on this recognition, the following sections provide a brief review of the experience and problems of both "plannings" while trying to integrate environment and development. This is followed by discussion of the potential contributions of various ecosystem sciences and ecosystem approaches to achieving the integration necessary to provide a research and policy framework for achieving sustainability.

Such a framework is called for in many governmental and academic documents (e.g., IUCN/UNEP/WWF 1991; Lubchenco and others 1991). The ultimate goal is a synthesis of ecosystem science and ecosystem approaches to provide a transdisciplinary framework that links biophysical and socioeconomic research and practice in a region or ecosystem through an holistic, ecological, and participatory methodology. This article draws on an earlier multidisciplinary review of ecosystem approaches (Slocombe 1991) and provides a theoretical context for case studies of particular regions and their institutional and administrative efforts to foster ecosystem-based, sustainable management (Slocombe 1992a,b).

Mainstream Planning, Ecology, and the Environment

It is difficult to define the nature of planning and the role of the planner. Most planners and planning theorists would agree with something like: "planning is collection and analysis of information to serve the public interest through guiding a wide range of human economic and other development activities" (see Friedmann 1987). The professional planner is an analyst and advisor to decision makers, rarely making decisions personally. There are many debates in the planning literature over the process of planning: How much of an advocate should the planner be? How and to what extent should the general public be involved in planning? What is the significance of the power that possession of information often gives to planners? (cf. Hudson 1979).

There is much less examination of more substantive questions related to the nature of the systems planners plan, and the types of information needed to plan them: Are there ecological limits to growth in this region? Can this region be (more) self-reliant? What are the links and trade-offs between economic, sociocultural, and ecological sustainability in this region?

Both kinds of questions are important. The process questions are central to planning theory proper and have led to significant contributions in several areas. For example planning practice and processes have been much improved by increased attention to public participation and issues of power (e.g., Forester 1989). Lessons learned about the methods and values of public participation have been incorporated into environmental planning and other activities such as environmental impact assessment.

Questions related to our understanding of natural and socioeconomic sciences are most central to planning for environment and development. It would be a significant step simply to have them inserted into the standard, existing planning processes at all levels. Early regional planning efforts asked questions, collected information, and used a synthetic methodology that did address substantive, systemic characteristics

(e.g., Geddes 1915, MacKaye 1928). Even in urban planning, useful, interdisciplinary roots have been lost (e.g., Howard 1946 on garden cities). Geddes coined the phrase "survey, analysis, plan" which is the planner's unofficial motto. Beginning a planning process with a comprehensive, multidisciplinary survey of the area to be planned is good, timeless advice.

In much modern practice, however, the survey is used or analyzed in a limited way. Typically, engineering and economic perspectives dominate, and rigid administrative boundaries at all levels are allowed to prevent management of whole, coherent regions. The constraints and opportunities identified do not adequately reflect ecological and sociocultural considerations. This reflects the post-WWII emphasis in planning on infrastructure development, on planning new places, and encouraging planned urban and regional growth.

By the 1960s and 1970s plans had become common and influential at many levels of government. When, at the same time, planners and planning theorists came to question their profession's orientation, they emphasized the process of planning: whether planners are truly objective, impartial experts; how and why the public needs to be involved; and what role planners should take in the process of managing cities and regions (cf. Hudson 1979). Regionalism was briefly revived, but useful experience during the 1930s and 1940s with comprehensive, regional approaches to, for example, river basin planning had been lost and was incompatible with 1980s political and economic philosophies (Deknatel 1986). Other concurrent experiments in regional planning, such as councils of governments, have often become mired in institutional difficulties, although in a few regions they effectively improved environmental planning (Alger 1982).

The process of developing plans, rather than the foundations of their analysis or prescriptions, is usually the focus of critical discussions. Yet some, almost incidentally, returned to the question of the biophysical and ecological context and limits on development (e.g., McHarg 1969). There were efforts to inject ecological concern into urban and regional planning (e.g., Linville and Davis 1976), but they have tended to be academic and/or demonstration projects. Others have sought to integrate economic, environmental, and policy issues and processes at a regional scale (e.g., Isard 1972, Nijkamp 1980). Yet as a recent review observes, they are strong on economic models, weak on ecological (as opposed to pollution migration) models, and treat the policy dimension in a simple, usually linear, way (Briassoulis 1986). These models and frameworks suffer from similar imbalances and weaknesses as mainstream planning and environmental planning.

The mainstream planning profession as a whole still emphasizes the process or procedural dimension of planning over the substantive: a very few efforts to transcend both the procedural/substantivist and the mainstream/environmental planning movements exist (e.g., Faludi 1985). While the negative environmental and social impacts of megaprojects, suburbs, and urban growth have long been known, only recently have "environmental" problems been framed in planning terms, but even then, it seems, by a whole new and largely separate kind of planning and planners.

Environmental Planning

Rather than integrating biophysical concerns into urban and regional planning, a separate discipline and profession of environmental planning seems to have emerged. The separate development of environmental planning is closely linked to environmental impact assessment; and in the United States, to the 1969 National Environmental Policy Act's requirement of environmental impact statements in particular (Caldwell 1982). Environmental planning also has roots in survey methods for identifying and presenting biophysical constraints and opportunities in planning (e.g., McHarg 1969). Both activities emphasize survey and inventory activities more than analysis.

The trouble with these sorts of activities—from McHarg to environmental impact statements to modern geographical information systems (GISs)—is that while they provide a tool for environmental planning they are not, alone, environmental planning. This is recognized in the resource and environmental management literature, if not always the GIS literature, which discusses GIS in the context of specific, broadly based resource management processes (e.g., Nielsen and others 1990). The core of integrated resource management has long been goal-oriented processes and coordination, not the data that support the process (e.g., Krutilla and Haigh 1978).

Adding ecological or environmental information to planning is not really enough (cf. Roberts and Roberts 1984). It may result in somewhat fewer truly bad decisions, but until the analysis goes beyond multidisciplinary lists and is an integral part of a comprehensive, forward-looking planning process, there is neither a basis nor an incentive for true linking of environment and development. It is no coincidence that environmental planning as discussed here is most

often required or used when a particular project has been proposed, when environmental impacts need minimizing, or when the development goal is secondary or minimal as in protected areas planning.

Environmental planning suffers from a bit of an identity crisis. It is relatively new compared to economic and mainstream planning. It is not so widely applied as it might be. It is not yet even an equal partner to, let alone an integral part of, traditional urban and regional planning whose goal is economic development, occasionally modified by concern for amenities and quality of life. Environmental planning is a little like environmental philosophy: the ideal situation from the perspective of environmental protection would be if it had no need for a distinct separate existence.

In the long term, integration of environment and economy is going to require the integration of both environmental information and the processes to utilize it wisely into traditional urban, regional (and corporate) development planning activities. This integration must occur both procedurally, in terms of perspectives and practices in the planning process (cf. Petak 1980), and substantively through widening of the domain of interest of both (cf. Petak 1981). Methodologies that seek to facilitate interdisciplinarity, interagency, and interpersonal cooperation and holistic, systems-oriented views have been a recurrent theme in both mainstream and environmental planning (see, for example, McLoughlin 1969, Holling 1978).

Another recurring and related theme is how to define and bound the areas of interest to planners. Typically, administratively defined areas such as cities or regions or parks are planned. Rarely do the boundaries of such units bear much resemblance to units defined by biophysical (or socioeconomic) similarity and integrity. Integrated regional environment and development planning should be based on more coherent, real, sustainable regions (cf. Sale 1985).

These points are reinforced by a recent review of theoretical orientations in environmental planning (Briassoulis 1989). In a work whose central analysis parallels Hudson's (1979) on mainstream planning, Briassoulis observed that neither the rational/comprehensive nor various "pure" approaches (e.g. advocacy, adaptive, participatory) to multifaceted environmental problems seemed suitable and politically realistic. Further, she identified a necessary future research agenda for environmental planning. Its main elements were in-depth case studies of environmental problems and their solutions; development of measures of the success of different planning approaches; examination of the influence of personal, professional, and technological factors; and incorporation of time into environmental planning approaches. Briassoulis concluded with the observation that "the body of environmental planning theory is still meager" (p. 390).

Environmental planning needs an integrated method and theory all its own. It cannot be really effective, really support sustainability, until it ceases to be a post-hoc exercise aimed at increasing acceptability and limiting negative impacts of major projects. Nor can environmental planning continue as a producer of demonstration projects which do, I fear, make up much of the literature. Planning for environment and development requires the attention to goals, the public interest, and the actors, politics, and process that have been a distinguishing characteristic of mainstream planning for the last 30 and more years. Simultaneously, environment and development planning requires the substantive, ecological and environmental contributions that have been the core of environmental planning for the last 20 years.

Although ecological knowledge alone will not provide the necessary synthesis; rapidly developing, interdisciplinary, systems-oriented ecosystem sciences have some particular contributions to make. A survey of these is presented in the next section, including an examination of interdisciplinary, ecosystem approaches that link both theory and method, substance and process.

Ecosystem Sciences

The concept of ecology is usually traced to the mid-nineteenth century. It developed as a science through the rest of that century. By the early twentieth century ecology was well established, principally as the study of animal populations, vegetational change, and succession. The term ecosystem was coined by Arthur Tansley (1935), who sought to provide a more precise and a more holistic term for the set of biological and physical factors that affect an organism: that form its environment. The current use of the term ecosystem by ecologists is for a local system, a distinct and coherent ecological community of organisms and the physical environment with which they interact. Typically defined as the study of the distribution and abundance of organisms, ecology progressed steadily in the mid-twentieth century with growing interest in a wide range of environmental influences on organisms. During the 1960s the contribution of ecology to understanding and managing a wide range of re-

source and environmental problems became one of its strengths. It was, of course, an inspiration to McHarg's resource survey work and to environmental impact assessment. It led to holistic, interdisciplinary interest in resource and ecological systems (e.g., Van Dyne 1969, Watt 1968).

Thus holistic, interdisciplinary study of ecosystems has been around for 20–30 years. It was strengthened and systematized during the 1960s and 1970s through the International Biological Programme and, later, the Man and the Biosphere Programme (see McIntosh 1985). Systems ecology has evolved to underscore the dual roles of structure and process (or function), or abiotic, biotic, and cultural factors in ecosystems through both field studies (e.g., Bormann and Likens 1979, Forman 1979, Likens 1985) and theoretical work (e.g., Odum 1983). Efforts to understand whole ecosystems in terms of the interaction of biological and physical components as modified by human action have extended our knowledge of the natural world considerably. Better knowledge of ecosystem structure, functioning, and evolution has supported understanding of ecosystem change and responses to stress (e.g., Odum 1969, Rapport and others 1985). In addition, ecosystem studies underscore complexity, disequilibrium, hierarchy and scale effects, and dynamics of ecosystems (e.g., Ellis and Swift 1980, O'Neill and others 1986, Schulze and Zwolfer 1987). Ecosystem science contributes to efforts to remediate and minimize the impacts of environmental change and stresses on protected and other ecosystems (e.g., Jordan, and others 1987, Kothbauer 1992).

Ecosystem science is a rapidly growing and fragmenting field. Today there is a variety of complementary methods and theories that are often described and implemented separately. Of particular relevance at a regional scale are conservation biology, landscape ecology, ecosystem risk assessment, state-of-the-environment reporting, and ecological integrity (see also Slocombe 1992c).

The lessons of conservation biology elaborate the implications of ecosystems becoming islands in a sea of different land uses, in a greatly altered landscape. Such islands may have difficulty maintaining species diversity, may not incorporate entire functional ecosystems, may require active management of populations due to small breeding populations, edge effects, etc. Conservation biology contributes to understanding the internal small-scale dynamics of populations and species within isolated ecosystems (Newmark 1987, Soule 1986). Conservation biology develops understanding of the managed area as an island, from the inside looking out.

In contrast, landscape ecology provides a view of a managed area as an island from the outside looking in. It identifies the protected area island as the remnant of a once much larger landscape element, now isolated in an otherwise modified, homogeneous landscape. It identifies the dominant landscape element, or matrix, and identifies other islands, and corridor and network features that may link islands into functionally larger systems. Landscape ecology suggests quantitative measures of landscape structure and function, and provides a framework for outlining the processes of connection and change between landscape elements (Forman and Godron 1986, Gardner and others 1987, Turner 1989). Landscape ecology has clear potential to inform and improve environmental and conservation planning (e.g., Hansson and Angelstam 1991, Naveh 1991), and a few efforts to integrate it with planning and policy processes are appearing (e.g., Zonneveld and Forman 1990).

State-of-the-environment reporting is an approach informed by much ecosystem science that seeks to formalize the collection and organization of relevant ecological, demographic, and economic data. What are the structural and functional features and characteristics of the protected area, and what is their current state? Such an assessment is critical for determining the effects of particular activities and the areas of the managed ecosystem that require more active intervention and protection. Such an approach emphasizes the need to understand cause-and-effect relationships and to monitor the managed area to track change and to aid in timely intervention (GEMS 1989).

Ecosystem or ecological risk assessment combines many of the insights of ecosystem science with toxicological data to develop spatial models of risk at a regional scale (e.g., O'Neill and others 1982, Graham and others 1991). The regional scale is important to capture cumulative effects and to ensure the model includes terrestrial/aquatic linkages and interactions. Such assessment could be a significant, new contribution to environmental decision and policy making, e.g., in environmental impact assessment (Suter and others 1987). It is particularly important for the experience and lessons that can be gained from it for integrating ecosystem science with policy-making process.

All of these approaches could usefully be used to collect and organize information for assessments of environmental planning and management problems and to identify interventions needed for more effec-

tive, better, management. Yet this begs the question of what is better; what are the goals of environmental planning and management? One synthetic topic receiving much attention is ecological integrity. It can be argued that the goal of ecosystem management should be to maintain ecosystem integrity. Indeed, since 1988 the Canadian National Parks Act has made maintenance of ecological integrity of national parks the first priority of management. Yet this is a difficult things to define, let alone to do (e.g., Anderson 1991). Significant quantitative work has been done on freshwater ecosystems (Karr 1991). Much more needs to be done. Such efforts depend on recognition that an ecosystem is a complex, connected system with functional and organizational properties inherent in and particular to that ecosystem.

Ultimately, efforts to define and model the integrity of local and regional ecosystems must integrate understanding and theories of their structure and dynamics. Attention is increasingly being focused on the implications of complex hierarchical structure (e.g., O'Neill and others 1986) and nonequilibrium, self-organizing, self-maintaining dynamics of intact ecosystems (Kay 1991, Slocombe 1990).

All these concepts, theories, and methods are to some extent holistic, interdisciplinary, and ecosystem oriented. Yet none of them is an explicit integrative process for planning and managing ecosystems and human activities for both environment and development. When we turn to management of actual ecosystems, drainage basins, bioregions, etc., we are faced with other problems: "ecosystems" larger than the traditional ecosystem of ecologists, a significant human presence and activity, and the need to integrate science with planning and management activities. Neither mainstream planning, environmental planning, integrated resource management, nor ecosystem science alone does this. There are some methodologies and case studies, e.g, Takeuchi and Lee (1989), Walters (1986), and Wright (1987), which appear to hold promise as examples of integration of scientific description and modeling into integrative, policy-oriented processes. Before returning to the elements of such an ideal process, we turn to more general "ecosystem approaches" to see what can be learned from them in terms of an overall framework for this integration.

Origins and Evolution of Ecosystem Approaches

The roots of ecosystem approaches are ultimately in ecology, but the term is a broad one and can be found in the literature of several disciplines including anthropology, human ecology, planning, management, political science, organization science, and psychology (Figure 1). Although a detailed review of the literature on ecosystem approaches is beyond the scope of this article, this section provides a concise review of the diversity and characteristics of ecosystem approaches (see Slocombe 1991, for a lengthy, multidisciplinary survey).

Most generally, an ecosystem approach is a methodology for studying an entity (a "system") that models it, its environment, and the interactions between them. The word ecosystem is used analogously to its use in ecosystem science; but the ecosystem is usually larger and of more varied composition. It may combine ecological and human dimensions or even be defined purely socially. Ecosystem approaches really seek to do two things: to define an "ecosystem" as the unit of study and to apply ecological concepts and analysis outside the traditional domain of ecology. Although both have been most widely undertaken in the last 20–30 years, there are much older examples.

In the 1920s human ecologists were probably the first to adapt and adopt ecological analysis. They studied people, their activities, and interactions with similar methods and goals to those of early ecologists (Park and others 1925, Duncan 1964, Duncan and Schnore 1959). The goal was to understand how people fit into their surroundings and distribute themselves and their groups in space, given particular resources and environments. Human ecology remains an important area of application and refinement of ecosystem approaches (e.g., Boyden 1987, Boyden and others 1981).

Another early area of application of ecosystem approaches was cultural anthropology. Ecological and later ecosystem approaches were adopted by some in order to provide a frame of reference for understanding sociocultural adaptation of people and societies to their biophysical environment (e.g., Forde 1934). As in human ecology, early applications of ecological ideas were in the context of debates over acquired versus inherited traits and behaviors (cf. Little 1982). In the 1940s and 1950s cultural ecology developed, most notably through the work of Julian Steward on cultural evolution and particular environments (Orlove 1980; Steward 1977). Ecological approaches were widely applied and developed from the late 1960s through the 1980s (Bennett 1969, Hardesty 1980). The ecosystem approach has become a tool for designing ecological anthropology research (see Moran 1990), and the connections between human ecology, cultural anthropology, and regional development

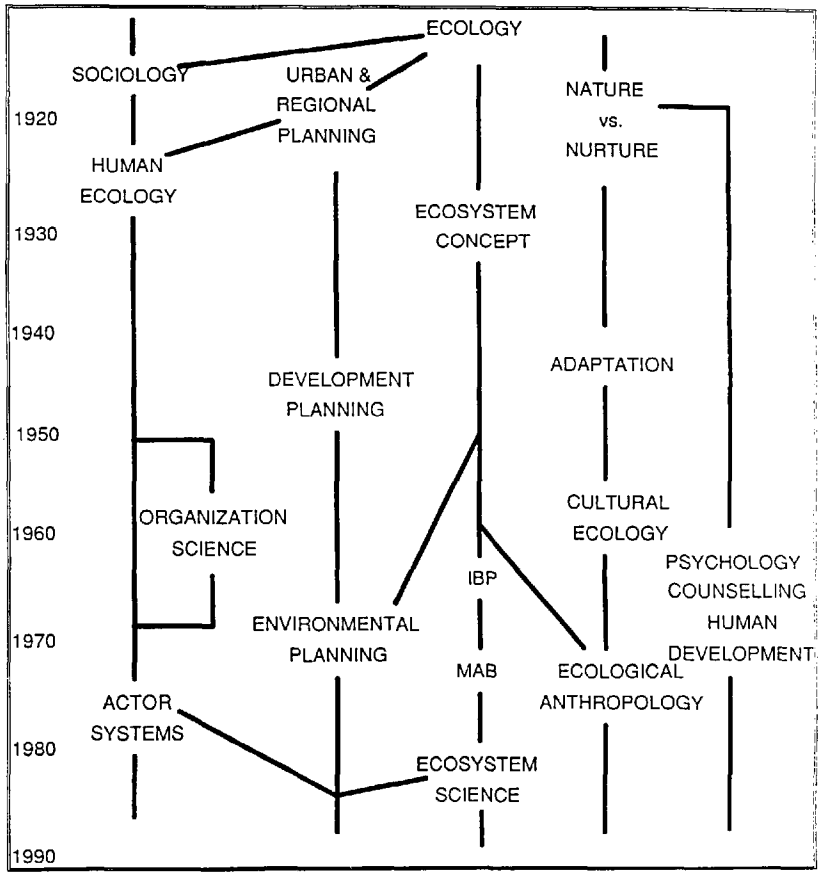

Figure 1. Origins and applications of ecosystem approaches

planning are becoming explicit (e.g., Smith and Reeves 1989).

Since the 1960s emergence of interest in ecology and ecosystems, there have been applications of ecosystem approaches in several humanities and social sciences. The collapse of civilizations has been seen as the result of systemic instabilities and mutually reinforcing processes instead of senility or decadence (Butzer 1980, Tainter 1988). Criteria for social choice structures have been derived from an ecological perspective (Dryzek 1987). In psychology, ecosystem approaches have received the most attention from counsellors and therapists. Here ecosystem approaches focus on the way a person perceives and relates to his or her environment. This environment is described in largely ecological systems terms. Individual growth and change are related to personal and interpersonal understanding and interactions (e.g., Bronfenbrenner 1979, Pardeck 1988). The individual's context, the transactions or interactions between the individual and others, the perception of the ecosystem, and individual processes of adaptation are all critical (Paolucci and others 1977). Positive and negative feedbacks and mutually reinforcing dysfunctional behaviors and cycles all play a part in determining how functional the individual is in his or her environment (Lustermann 1985).

Concurrent with the 1960s boom in ecosystem science studies was at least some interest in broader ecosystem approaches. On the environmental front it was motivated by analogies between the dynamics and complexities of ecological systems and human societies and a concern to plan and manage human societies within their ecological context and constraints (e.g., Darling and Dasmann 1969). Robert S. Dorney was an ecologist and planner who early looked at ecosystems in a planning context (e.g., Dorney 1973, Dorney and McLellan 1984) and developed an approach to environmental management based on it (Dorney 1989).

Explicit ecosystem approaches to regional environmental planning and management, distinct from environmental planning as discussed above, are few. Their best known and most influential application is in the Canadian and American Great Lakes Basin. The concept was enshrined in the 1978 Great Lakes Water Quality Agreement (US National Research Council and Royal Society of Canada 1985) and underlies such goals as zero discharge of persistent toxic

substances and Remedial Action Plans for Areas of Concern (Hartig and Vallentyne 1989). As applied in the Great Lakes Basin, the ecosystem approach is holistic, interdisciplinary, goal-oriented, participatory, and aimed at getting people to recognize they are a part of the ecosystem—not separate from it (see Vallentyne and Hamilton 1987). The approach has a strong administrative and institutional orientation, in large part aimed at improving management and coordination by the many institutions with management responsibilities in the Basin (cf. Caldwell 1988).

It should be clear that ecosystem approaches have seen wide application in a variety of fields. Some of these applications go back almost to the turn of the 20th century, but most can be traced to the widespread interest in and dissemination of ecological ideas in the 1960s and 1970s. Even in disciplines with a long history of interest in ecological ideas, even in ecology itself, that time was fruitful and eventful. One could say that there has been a long-lasting and widespread, but always minority, tradition of ecosystem approaches that is distinct from ecosystem science. The next section provides an analysis of the nature of ecosystem approaches in different disciplines.

Defining and Assessing Ecosystem Approaches

Ecosystem approaches are different things to different people and different disciplines. Although for some this variety is a strength, overall it has probably neither increased the use nor the scientific respectability of ecosystem approaches. To an ecologist, an ecosystem approach implies study of either an entire local ecosystem in all its biophysical and perhaps socioeconomic complexity or study of an organism in its ecosystemic context. To idealize a little, the latter is essentially what human ecologists, psychologists, and political scientists using an ecosystem approach do, with primary emphasis on socioeconomic and cultural factors. The former, to a more or less comprehensive degree, is what anthropologists, environmental planners, and the like do. Although some ecological scientists do not like it, the phrase "ecosystem approach" seems a useful and acceptable generalization, at least until some other term, such as was noted in the introduction, becomes more widely accepted.

The rest of this section briefly reviews the characteristics of the most developed, explicit, ecosystem approaches: in human ecology, anthropology, psychology, and environmental planning (see Table 1 for a summary). This review provides the basis for a characterization of what an ecosystem approach is and a discussion of its advantages and disadvantages.

Table 1. Comparison of ecosystem approaches in several disciplines with Great Lakes environmental planning

Human ecology
Interest in people, human systems and the dynamics and interactions
Focus on interactions within system and with environment
Multidisciplinary study of system structure and functioning aimed at gaining understanding
Anthropology
Diverse: empirical, quantitative, equilibrial to theoretical, change- and model-oriented
Multidisciplinary systemic, societal, dynamics focus
Biophysical and socioeconomic structure/process interactions
Understanding evolution, interaction, adaptation of societies to their environment
Psychology
Focus on structure and function
Family system and its environment
Understanding system problems (function or adaptation) as multiply caused
Great Lakes environmental planning
Comprehensive consideration of variables making up the system
Including people in the ecosystem; participation
Integration or synthesis of knowledge, holism
Interaction of biophysical, socioeconomic, and institutional dimensions
Expectation of management and criteria for management action; anticipation

In human ecology there is an emphasis on dissecting ecosystem (either local or regional) structure and components and identifying their interactions with the larger biosphere or surrounding human societies (Boyden 1987). Many applications of human ecology use detailed descriptions of system structure and simulations of dynamics, quite similar to those which an ecologist would apply to study a local ecosystem (cf. Boyden and others 1981, Netting 1981). Such approaches are usually strongly multidisciplinary, seeking some sort of synthesis in understanding the functioning of the entire human and ecological system.

Ecosystem approaches take on a wide variety of forms in anthropology. For example, Ellen (1982) suggested they include a version of systems analysis, an interactionist model derived from the ecosystem concept, and causal hypotheses of a cultural materialist type. Ecosystem approaches range from the strongly empirical, quantitative, and equilibrial in orientation to the strongly theoretical and change-oriented. They also range from the local to the societal

and from the functional to the evolutionary. The current trend, however, is probably toward systemic, societal, dynamic approaches utilizing a range of theories and data. Many (e.g., Bennett 1969, Forde 1934) focus on the links between biophysical and socioeconomic processes and structures, often to understand evolution and adaptation of societies to their social, economic, and natural environments. Moran (1984) sees ecosystem approaches as providing an integrating framework for studies of the interactions between human populations and with their environment. Such studies emphasize systems models of matter, energy, and information flow and of the human–habitat interaction.

Ecosystem approaches in psychology tend to be slightly different variations on a similar, common theme. Bronfenbrenner (1979) emphasized processes and structures at different scales, spatial locations, and hierarchical positions with effects on the individual. In Paolucci and others' (1977) study of the family, the focus is on family structure, organization, and environments and on functioning and adaptation within and between these elements. Similarly, Pardeck (1988) and Lusterman (1985) focus on interactions between people and their environments and on the context of individual problems as a coproducer of them.

A review of the ecosystem approach and the Great Lakes Water Quality Agreement identified three key characteristics: comprehensive consideration of the variables making up the basin ecosystem; consideration of the interactions of biophysical, institutional, and socioeconomic subsystems; and an accompanying expectation of management and criteria for management actions (US National Research Council and Royal Society of Canada 1985). Similar criteria for an ecosystem approach were identified by Vallentyne and Hamilton (1987): integration or synthesis of knowledge, a holistic perspective, ecological actions, anticipatory actions, and ethical actions. Several authors have underscored the importance of this core of characteristics in environmental management contexts (e.g., Lee and others 1982, Risser 1985). What is rare, as discussed above under environmental planning, is a process and methodology that actually embodies them.

From this review it is possible to identify a range of core characteristics of ecosystem approaches. Table 2 lists these in approximate order from most to least important and/or common. What is most fundamental to ecosystem approaches in these varied disciplines is an emphasis on a particular system and its environment, on interactions within and between them, and the use of an holistic approach to understanding these elements.

Table 2. Core characteristics of ecosystem approaches

Describing parts, systems, environments, and their interactions
Holistic, comprehensive, transdisciplinary
Including people and their activities in the ecosystem
Describing system dynamics, e.g., with concepts of homeostasis, feedbacks, cause-and-effect relationships, self-organization, etc.
Defining the ecosystem naturally, e.g., bioregionally, instead of arbitrarily
Looking at different levels/scales of system structure, process, and function
Recognizing goals and taking an active, management orientation
Including actor–system dynamics and institutional factors in the analysis
Using an anticipatory, flexible research and planning process
Entailing an implicit or explicit ethics of quality, well-being, and integrity
Recognizing systemic limits to action—defining and seeking sustainability

Of course, ecosystem approaches have not been universally, critically accepted. They have both advantages and disadvantages, and discussion is complicated by the fact that one person's advantages may be another's disadvantages. Ecosystem approaches are subject to many of the same criticisms as systems approaches in general (e.g., Berlinski 1976). How is the "ecosystem" defined? There is a lot of reliance on analogy and comparison. The approach is too broadly applicable. It overlaps or duplicates methods and work proper to other, specialized disciplines.

There are also more specialized critiques and concerns, related to the way ecosystem approaches are used. Anthropologists have provided the most sustained and detailed evaluations. Their most important concerns are with ecological determinism, generalizing from ecological to socioeconomic systems, neglecting socioeconomic factors such as power relationships, overly functionalist interpretations, reification of models, and both overly quantitative and overly qualitative approaches (e.g., Moran 1984, 1990; Winterhalder 1984, McCay 1978). There has been concern in human ecology for the superorganismic emphasis that sometimes arises and suggestions that approaches more akin to the individualist one in ecology would be more appropriate as a methodological base (Haines 1985). Kreiger (1977) raised concerns from the perspective of the planning profession about drawing lessons for socioeconomic systems

Table 3. Advantages and disadvantages of ecosystem approaches

Advantages	Disadvantages
Comprehensive, holistic approach for understanding whole systems	May neglect sociocultural issues such as politics, power, and equity
Different view of science that recognizes diversity of cause and effect, uncertainty, and the probabilistic nature of ecosystems	Ecological determinism: danger of generalizing from biophysical to socioeconomic systems
Drawing on theory and methods from different fields to generate models and hypotheses	Nebulous: a vague, superorganismic theory of poor empirical foundation, that relies on analogy and comparison
Contributes to understanding limits, complexity, stresses, and dynamics	Nonstandard definition of "ecosystem"
Encourage preventative thinking by placing people within nature	Reification of analytical systems; in some approaches linked to reductionist and equilibrium views
Facilitates locally appropriate, self-reliant, sustainable action	Narrow spatial focus on local ecosystem structures and processes
Facilitates cooperation, conflict reduction, institutional integration	Functionalist and/or energy analysis are overemphasized
Requires recognition of mutual dependence on all parts of a system: e.g., natural/cultural, person/family	Duplicate and/or overlaps other disciplines without a special contribution of its own
Results in criteria for management actions	If ecosystem approaches can apply to everything they're meaningless

from ecological ones and argued that the most important issues are ones of politics, power, and equity, about which ecology says little.

Ultimately, one's support for ecosystem approaches, as for systems approaches, depends on whether one thinks their advantages and unique contributions outweigh the potential for vagueness, functionalism, and the like. Table 3 summarizes the advantages and disadvantages of ecosystem approaches. The next section compares an ecosystem approach with the approaches of mainstream planning, environmental planning, and ecosystem science.

Ecosystem Planning, Sciences, and Approaches Compared

Table 4 presents a comparison of goals and characteristics of mainstream planning, environmental planning, ecosystem science, and ecosystem approaches. All have particular contributions to make. Some emphasize description; others are more prescriptive. Some derive from economics and social sciences; others more from natural science. Some focus on process, some on substance. Some consider people as separate from ecosystems; others include them within.

Which is "better," depends on the problem and on the goals of the user. This article began with recognition of the need for sustainable development and constitutes an extended argument for the need for better integration of environment and development planning than is found in any existing discipline or profession. There is a vast literature on the difficulties of achieving this integration and the changes that need to be made to do it. Some of these have been referred to throughout the preceding sections. The integrated resource management literature is particularly relevant (e.g., Dahlberg and Bennett 1986, Lang 1986, Miller and others 1987). The differences between integrated environment and development planning and integrated resource management are little more than an explicitly broader emphasis and a potentially stronger methodological orientation.

To summarize, commonly identified needs include better use of environmental information in planning; better understanding of biophysical and socioeconomic interrelationships; better coordination of the activities, and rationalization of the goals, of diverse institutions; more participatory processes that utilize local knowledge and seek to meet local needs and develop societal commitment to sustainability; better recognition of limits to growth; better consideration of alternatives to the usual way of doing things; and many others (e.g., Thompson 1987).

It seems that what is really needed is an approach or framework that combines the procedural strengths and integrates the substantive contributions of various older sciences and professions in the new context of seeking to integrate environment and development. We can and must build on past lessons and disciplinary expertise. Mainstream planning has

Table 4. Comparison of goals and characteristics of mainstream planning, ecosystem planning, ecosystem sciences, and ecosystem approaches

Mainstream planning
Seeks to serve the broad public interest through guiding a wide range of human economic and other development activities.
Is advisory and process-oriented; uses rather than creates information.
Methods have strong roots in economics, social science and design disciplines; models are often optimizing, linear.
People separate from natural systems; works within political and administrative boundaries.
Environmental planning
Seeks to ensure ecological considerations are included in planning and management of human activities.
Usually advisory and participatorily, process-oriented. Often leads to/relies on survey/inventory methods. Sometimes emphasizes process, sometimes substance. Often utilized in response to particular problems and needs.
Methods have strong roots in ecological and social sciences. Although often merely descriptive, advocates have urged comprehensive, interdisciplinary, holistic approaches.
People usually part of system; some efforts to work with natural planning units.
Ecosystem science
Seeks to describe structure and function of ecological systems.
Is systemic, interdisciplinary within the natural sciences, with a strong interest in scale, pattern, and process in biophysical systems.
Methods are natural science derived: quantitative, predictive.
People and their activities increasingly considered within ecosystem; but strict use of term limits its planning relevance.
Ecosystem approach
Seeks to produce understanding of the structure, function, and interactions of a system and its environment.
Explicitly holistic, transdisciplinary; seeking to integrate biophysical and socioeconomic dimensions with input from many disciplines.
Redefines ecosystem naturally, includes people within it; incorporates goals, participation and recognition of limits, need for sustainable actions.
Is at once descriptive and prescriptive: being a framework for integrated study, analysis, and planning.

taught us much about the means of working with people to meet their goals and needs in many contexts. Environmental planning has developed many simple and widespread methods for organizing and using environmental information. Ecosystem sciences provide us with basic knowledge of the workings of the biophysical environment. In this article, the problem faced is that of developing a societal, regional-scale planning that facilitates the integration and achievement of both environmental and developmental needs and goals.

This new environment and development planning will have to be systematic and systemic; draw on disciplinary knowledge to generate transdisciplinary knowledge; and involve people and learn what they know and want. Based on Tables 2, 3, and 4 and the associated discussions in the text, it is argued that ecosystem approaches appear to offer the widest range of desirable characteristics, the most diverse experience, and the best prospects for devising such a framework. Ecosystem approaches can facilitate studies that integrate knowledge from a range of disciplines about an area or society or person; they encourage recognition of complexity, change, and the need to adapt to and anticipate it. They promote an appreciation of people's place within rather than separate from nature, and they promote involvement of people in surveys, analysis, and plans.

Conclusion

Developing a substantively and procedurally new planning mechanism that integrates environment and development will not be a simple task. There can be little question of the need for integration of environment and development planning. This article has outlined the problems and illustrated the nature and potential of an ecosystem approach to facilitate this integration. Working toward this integration is important for linking of biophysical and socioeconomic activities; the emphasis on local needs and opportunities, the focus on self-reliance and self-organization, the building in of goals and participation, the adoption of a systems approach are all at the core of what many current writers see as critical needs for achieving sustainability (e.g., Gardner 1989). If the goal of sustainability is to remain as widespread and popular as it is now, then some method for moving toward it, planning for it, is essential.

Sustainability, and integrated environment and development planning to support it, will almost certainly not happen suddenly; rather it will evolve and co-

Table 5. Basic characteristics of an ecosystem approach to integrated environment and development planning

Substantive characteristics	Process characteristics
Inter- or transdisciplinary	Participatory
Uses a systems approach to describe structure, process, and dynamics	Seeks individual and institutional cooperation and integration
Uses multiple theories and methods	Defining and moving toward goals
Adaptive, using monitoring and evaluation to gather and assess info	Facilitating dissemination and use of information
Generating hypotheses and models	
Future, long-term oriented	

alesce from diverse efforts in the disciplines and professions mentioned in this article. Defining and elaborating a full ecosystem approach to regional environment and development planning is a large, on-going and adaptive task. Such an approach will need to address both the usual, substantive concerns of environmental planning and ecosystem sciences and the traditional, process concerns of urban and regional planning. Table 5 presents an initial outline of the basic characteristics of an integrated framework. This can serve as a starting point for further elaboration and as simple criteria for assessing current planning processes.

The different roles and relative importance of quantification, description, well-designed processes, formalized methodologies, conceptual schemes, and other tools will need to be examined. A first step will be elaborating detailed information requirements and a methodology for studying regional ecosystems (Slocombe 1992a). Whatever the specific results of that elaboration, one of the strengths and necessities of ecosystem approaches will be their flexibility and the need to tailor them to particular situations.

A second stage will more fully explore institutional possibilities, and their scientific and procedural needs and opportunities. A complementary article explores the practical, on-the-ground impetus for an ecosystem approach and discusses some case studies of movement toward ecosystem approaches in regional environmental planning in the Beaufort Sea/North Slope of the Yukon and Northwest Territories, the Kluane region of the Yukon, and the Australian Alps region of southeast Australia (Slocombe 1992b).

Ultimately, this article has tried to review and synthesize the wide experience with ecosystem approaches in varied disciplines. Through this, it is meant to facilitate and catalyze discussion and exploration of better ways to integrate planning for environment and development. I have argued for a particular starting point on the basis of certain problems and needs in the preceding pages. This could at least be a common point of departure for systematically examining and extending current practice and research.

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