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Understanding the Links Between Ecosystem Health and Social System Well-Being: An Annotated Bibliography



Compilers

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Abstract

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This bibliography focuses on the links between social system well-being and ecosystem health. It is intended for public land managers and scientists and students of social and natural sciences. Multidisciplinary science that addresses the interconnections between the social system and the ecosystem is presented. Some of the themes and strategies presented are policy and management processes, ecosystem management, conceptual approaches, sociocultural processes, ethics, economic perspectives and analysis, methods and indicators for assessment, and environment-human interactions. This bibliography identifies the contributions toward understanding the links between ecosystems and social systems made by historically disparate disciplines.

Keywords: Ecosystem health, social system well-being, sustainability, natural resources, human ecology, environment-human interactions, links, interconnections, economics, ecosystem management, social values, ethics, indicators, methods.

Introduction

This bibliography focuses on the links (exchanges and products of the relation) and interconnections (the nature of the relation) between two broad systems: the ecosystem and the social system. By using the terms social system and ecosystem we are not suggesting that they are indivisible or separate from each other; rather, their use represents convenient disciplinary lines by which we organized our investigation of the literature. In addition, we are not suggesting that conceptualizing the human-environment relation as two spheres of phenomena is the best or most accurate representation of reality. The **best** conceptualization of the relation between non-human and human phenomena is largely a matter of the observer's objectives and needs. In some circumstances, it is more useful to conceive of the social system as embedded in the ecosystem. For other objectives, one may illustrate these two systems as overlapping or depict the economic and sociocultural phenomena as separate on the same order as ecosystems. In addition, there are many popular models that do not focus on systems per se, but rather represent the nonhuman sphere as natural resources, stocks, or environmental services.

Our primary objective is to draw together the literature that addresses how the state of one system affects the condition of the other system. The "environment," "ecosystems," and "natural resources," are all terms that name some part or aspect of the world that is not generated by humans although it may be manipulated or even transformed by humans. The concept of "ecosystem," an abbreviation of ecological system, was chosen as the focus for this bibliography for various reasons. One primary reason is that a systems approach appropriately places the level of analysis on the whole system, rather than its parts (Goldberg 1989). In addition, it connotes the process of function and elements of flexibility within the environment, rather than depicting the environment as a static, unchanging entity. A systems approach acknowledges the temporal dynamics of the environment and its qualities that allow for variation within its domain of stability and therefore its resilience to disturbance or shock (Goldberg 1989). As we discussed above, we are concerned with how the state of the environment affects or is affected by the state of the social system. Therefore, we have coupled the term "ecosystem" with the concept of "health." We recognize this combination of concepts is a source of much debate (for example, see De Leo and Levin 1997) and do not intend to evaluate "ecosystem health" as a framework to assess and guide the management of ecosystems. Rather, we incorporated the normative concept of "health" because it allows questions of how the condition of the environment is connected, by cause or otherwise, to the condition of the related social systems.

Although the literature on natural resources often depicts the economy as being separate from sociocultural phenomena (see Hodge 1997 for a review), we have chosen to approach social, cultural, and economic phenomena as all aspects of the social system. Approaching human-generated phenomena as a "system" allows our inquiry to focus on the function, resiliency, and integrity of social, economic, and cultural processes. Similar to our coupling of ecosystem with health, we also have coupled social system with a concept depicting the system's state: "well-being." "Well-being" has been widely used but not rigorously defined, most likely because its definition depends on the values of the particular subject(s). It has been defined on the basis of agency and abilities of individuals (Sen 1985), used to represent general community welfare (Richardson and Christensen 1997), and assessed through socioeconomic status and community capacity (Doak and Kusel 1997).

Like the concept of health, well-being is a normative concept based on how one defines the “good life” and reflects the general condition of people’s lives. Although being physically healthy is also a condition of human well-being, we have omitted the literature that deals solely with human health. Rather, we have kept our focus on well-being at a scale greater than the individual such as the family, community, region, and beyond.

The concept of links addresses the connectivity and interactions between different aspects and components of our ecology. Although people have acknowledged the existence of links between the environment and the economy, such as outlined in the Brundtland Report (WCED 1987), they are, for the large part, still considered separate arenas of activity (Myers 1993). In this context, we use “links” to mean a relation (causal, parallel, reciprocal, or otherwise) or connection between ecosystem health and social system well-being. This definition intentionally has been left unbounded so as not to limit the bibliography to a specific conceptualization of interaction between humans and the environment. In addition, as opposed to cataloguing a number of approaches from different disciplines, we included references that used innovative interdisciplinary approaches.

Approach to This Bibliography

The literature is drawn from numerous disciplines including, but not limited to, sociology, anthropology, forestry, political ecology, ecological economics, systems studies, urban forestry, and development. Several themes found in the literature provide potentially complementary views from many disciplines. When multiple references addressed the same topic, we placed preference on the references that most thoroughly developed the argument, provided a review of the literature on the given subject, and, when possible, substantiated the argument with quantitative or qualitative evidence. As much of the work on the relation between ecosystems and social systems is still in its nascent stages, a majority of the current literature tackles the conceptual approaches that may allow for interdisciplinary analysis.

There are many references that were excluded for logistical reasons. Although we tried to draw from international examples of research on the human-ecosystem interface, language barriers hampered the diversity of references available to us. As a result, this bibliography focuses on North America with some representation from Asia, Africa, and Europe.

Our goal was to bring together a truly multidisciplinary assemblage of theoretical perspectives and research that contributes to the understanding of the human-ecosystem interface. We searched the natural science disciplines for work that examined both natural and social phenomena, but those attempts were, for the large part, unfruitful. Although our greater familiarity with the social sciences aided our attempts at drawing examples of social inquiry together, there simply are more efforts for integrated conceptual approaches in the social sciences than in the natural sciences. As a result, this bibliography is weighted toward the social sciences. In addition, the bibliography also reflects our professional orientations toward natural resource policy and management issues as well as rural studies.

The annotations are written to help readers identify references that best address their information needs and questions. As a result, many of the annotations are written much like an abstract focusing on content of the particular reference rather than

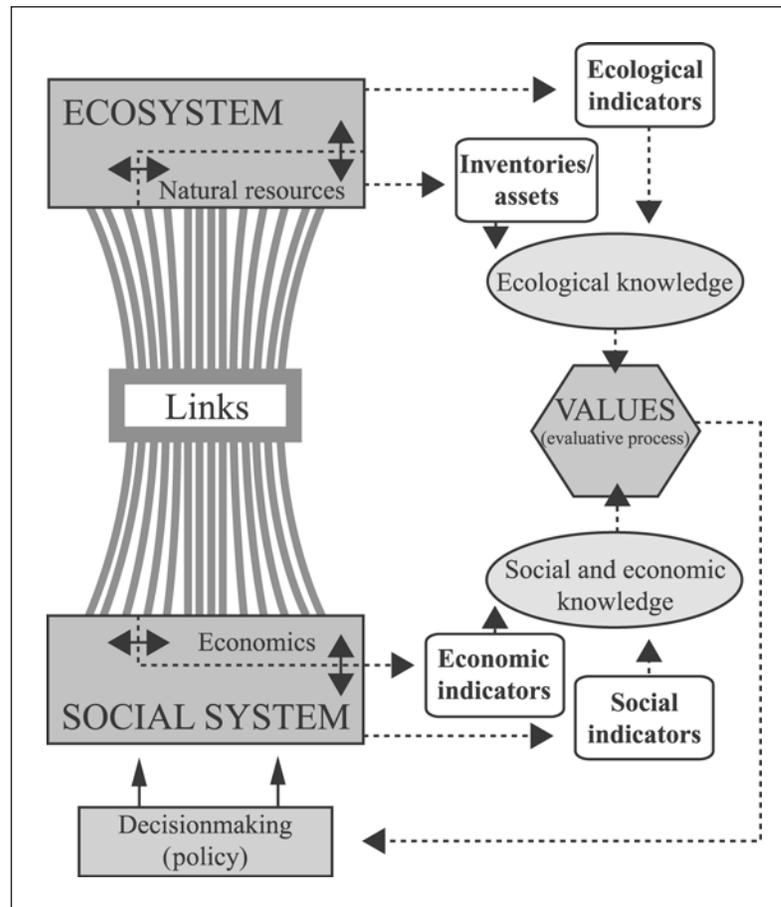


Figure 1—Conceptual approach.

evaluating it within the larger body of literature. As integrative approaches to social-environmental questions and problems are relatively new, many of the annotations stress the methodological and conceptual approaches to problem analyses rather than the author(s)' conclusions. The annotations differ in length depending on the type of reference, with books having substantially longer annotations than individual articles. Also, although an entire book may be referenced, the annotation may focus on a specific section or group of chapters that most reflect the topic of this bibliography.

To capture the range of links between social system well-being and ecosystem health, we developed a conceptual framework that drew from systems thinking. The framework recognizes the two-way nature of exchanges between social and ecological systems, allows for the acknowledgment of tangible as well as intangible benefits the social system gains from the ecosystem, and finally, accounts for limitations in our understanding and knowledge of system processes. Figure 1 is a graphic representation of our conceptual approach. The ecosystem and the social system are the two primary fields of phenomena represented in this framework. The lines between them depict certain aspects of the human-environment interface including

stress, restoration, resources and services, social meaning, and many other links. Natural resources are incorporated into the ecosystem, and the double-sided arrows indicate the interactions between natural resources and the ecosystem. A similar hierarchy is presented in the social system, with economics being depicted as a component of the social system. The dotted lines represent information that is available for analysis. Information is collected in the form of data based on specific indicators. The knowledge that can be garnered from the data is restricted by limitations in our knowledge of ecosystem as well as of social system processes and relations. Furthermore, the interpretation of the information and resulting knowledge we gain from the analysis of indicators are shaped by human values.

Themes Found in the Literature

Many references present policy and management perspectives of the human-environmental relation or suggest management and policy approaches that will better harmonize objectives for ecosystem health and social system well-being. Berkes and Folke (2000) explore management approaches to linking social and ecological systems. Hanna et al. (1996) and Myers (1993) address links between ecological and economic systems. Lee (1993) addresses the role of science and political processes in determining the human-ecosystem relation. In addition, there are two references that consider a specific form of resource management—common property regimes. Bromley (1992) provides an overview of conceptual, empirical, and theoretical implications of managing common property resources; and Wichkramasinghe (1997) examines common property resource regimes in Sri Lanka and suggests what qualities of such management policies are required for sustainable resource management.

In addition, we have included references on a specific policy and management approach: ecosystem management. Ecosystem management is a management approach based on whole ecological systems and facilitates analysis at multiple ecological scales. The primary objective of an ecosystem management approach is the maintenance or restoration of ecological integrity, resilience, and health. In general, an ecosystem approach includes the consideration of human and social systems. The integrity and health of ecosystems are affected, positively or otherwise, by the values, needs, and behaviors of their human components. Although most ecosystem literature focuses on the biological, technical, and logistical aspects of ecosystem management, there has been an increase in attention to the social, economic, and political aspects of managing for ecological integrity (for example, Alden and Shaw 1993, Crumpacker 1996). De Leo and Levin (1997) discuss the conceptual underpinnings and approaches to ecosystem management. Crumpacker (1996) reviews different conceptions of ecosystem management and draws attention to the important role of social values. Finally, Alden and Shaw (1993) is included as an example of an ecosystem approach that places emphasis on both the health of the ecosystem as well as the role the ecosystem plays in the social and cultural well-being of associated peoples.

Many references represented here address conceptual understandings and frameworks including conceptual orientations used in ecosystem and environmental management. Two books address the concept of ecosystem health and its potential role in environmental management. Rapport et al. (1998) explore the emerging field of ecosystem health and its contributions to environmental management, whereas Costanza et al. (1992) examine the philosophical implications of coupling the terms

health and ecosystem. Norton (1991) evaluates the concept of ecosystem health and examines ways in which ecosystems are conceptualized. In addition, Machlis et al. (1999) examine a human ecosystem framework for ecosystem management.

Additional references that profile different philosophical orientations that can aid in our understanding of the links between ecosystems and social systems are included. Bennett (1993) provides a general problem analysis of the contemporary environmental dilemma and profiles the historical, current, and potential contributions of anthropology toward understanding that dilemma. A "biohistorical approach" is the subject of Boyden (1992), and Bradley (1993) explores the contribution that ecological economics can make toward integrating ecosystem and social system health. Barkin and Levins (1998) explore the ecosocial dynamics of rural systems to inform the process of economic development so that we may depart from the trajectory leading toward social and environmental degradation. Finally, there is one reference on philosophical orientations that is particular to forestry. Hytonen (1998) looks at conceptual trends in the development literature to understand what socially sustainable forestry may entail.

There are references that analyze or place emphasis on social and cultural processes in order to understand social-environmental interactions. The number of references using a social science approach, relative to other disciplines, may reflect our greater familiarity with the social sciences, a greater concern for integrated understandings on the part of social scientists, or both. Some references examine the social and cultural phenomena that shape resource use and extraction such as social meaning (Butz 1996, Mosse 1997), social institutions (McCay and Jentoft 1998, Mosse 1997), and ritual (Rappaport 1984). Little and Horowitz (1987), Painter and Durham (1995), Eder (1990), and Jodha (1995) all examine ways in which characteristics of the sociocultural system can and do lead to environmental degradation. Dunn (1997) looks at the rate of change in social and cultural circumstances in determining if communities can adapt and change social and ecological conditions before environmental degradation occurs. Finally, two references that profile a specific disciplinary approach are included. Moran (2000) profiles ecological anthropology and suggests that the study of human adaptability can inform the integration of our understanding of social and natural systems. Berkes (1999) considers the emerging field of traditional ecological knowledge and discusses related concepts, practices, and issues.

References that address the ethical dimensions of human-environmental interactions also are presented. Jamieson (1996) examines the concept of "sustainability" and argues that what is missing from the discourse is a discussion about the appropriate relation between humans and nature. Jenkins (1998) also addresses human-environmental interactions and explores ways in which a land ethic may be formed. Two additional references in this section address specific value systems in the development of land ethics. Jostad et al. (1996) look at Native American land ethics and their application in tribal land management. In addition, Rolston and Coufal (1991) use a historical perspective to study the ethics used in the Society of American Foresters' Code of Ethics and suggest that a land ethic based on a biosystem orientation to natural resources would allow for an ethical approach more germane for foresters in today's society.

Perspectives born from economic theory or economic analysis in understanding the relation between people and the environment also are presented. Jansson et al. (1994) introduce the subfield of ecological economics, its philosophical orientation, and the potential contributions it can make for progress toward sustainable development. Two additional references examine the relation between people's state of economic well-being (poverty or high income) and environmental degradation (Dasgupta 1993, Torras and Boyce 1998), whereas Power (1996) looks at the relation between environmental protection and economic well-being. Daly and Townsend (1993) present a diversified discussion of the relation between economic growth, economic health, ecological constraints, and ethical considerations. Finally, Xu et al. (1995) introduce a resource accounting system that accounts for both the current values of forest resources and their future values.

Some references focus on measurement and indicators for assessment. Although many studies noted above use indicators as part of their methodology, in a few references, indicator use is the object of study. Three look at the benefits and utility of using social indicators in environmental management (Azar et al. 1996, Force and Machlis 1997, Parkins 1999). Other themes present are the focus on human aspects of sustainability (Michalos 1997) and combining indicators from different disciplines to reach a better understanding of the human condition (Cole et al. 1998, Michalos 1997). Hodge (1997) presents an evaluative review of 29 conceptual frameworks that serve to inform the use of indicators in assessing progress toward sustainability.

Finally, references that holistically examine human-environment interactions also are presented. Some references examine the relation between ecosystem ill-health and social ill-being, focusing on environmental scarcity, degradation, and social conflict (Baechler 1999, Homer-Dixon and Blitt 1998). White (1980) uses a historical human ecology approach to provide an indepth investigation of the relations between humans and ecosystems in a specific place. Firey (1960) also investigates the relation between humans and ecosystems, but unlike the case-study approach of White (1980), Firey (1960) attempts to outline a universal model of natural resource and land use. Finally, Di Giulio and Monosson's (1996) edited volume on the interconnections between human and ecosystem health attempts to "open the lines of communication" across disciplinary boundaries and includes contributions from many specialists interested in human-ecosystem connectedness.

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References

1. **Alden, E.F.; Shaw, D.W. 1993.** Managing piñon juniper ecosystems for sustainability and social needs: proceedings of a symposium. Gen. Tech. Rep. RM-236. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 169 p.

Contains presentations and papers presented at a symposium. The purpose of the symposium was to review the current state of knowledge concerning piñon-juniper (PJ) ecosystem resources and to assist land agencies in the development and management of the PJ ecosystem in the Southwest, U.S.A. Thirty-seven chapters are included, touching on topics such as the history of human-nature interactions in PJ ecosystems, ecosystem approaches to PJ management, land cover patterns, multiple-resource management of PJ systems, rural economic opportunity in PJ systems, commercial potential of nontimber forest resources, erosion, and a strong emphasis on spiritual values of PJ systems for Southwest Indian cultures. Dominant themes in the volume include the need to consider the relation between traditional people's cultures and their environment, the urgent need to restore the health of the PJ ecological system and especially watershed conditions, establishing sustainable management patterns, the need for multiple stakeholder participation in management, and multiresource management including the commercialization of some nontimber PJ resources. An action plan based on the piñon-juniper symposium identifies actions that organizations could take to improve the management of PJ ecosystems in New Mexico for ecosystem sustainability and social needs. Thirteen goals of the action plan and 15 recommended actions are outlined.

Keywords: Piñon-juniper forests, resource management, social values, cultural impacts, human environment, sustainability, Southwest U.S.A., New Mexico.

2. **Azar, C.; Holmberg, J.; Lindgren, K. 1996.** Socio-ecological indicators for sustainability. *Ecological Economics*. 18(2): 89-112.

Much discussion has been aimed at determining the best ways to assess our progress toward sustainability. Most measurements of sustainability are based on the state or condition of the environment; here the authors propose that attention should be directed toward the relation between society and the ecosystem and focus placed early in the causal chain. Instead of relying on environmental indicators, the authors argue that indicators based on societal activities will have significant advantages including the ability to foretell environmental degradation that may be the result of current societal behavior. Azar et al. suggest that socioecological indicators should be based on a framework for sustainability, especially on socioecological principles of sustainability. The four socioecological principles identified are (1) substances extracted from the Earth's crust must not systematically accumulate in the ecosphere, (2) society-produced substances (both naturally existing and synthetic) must not systematically accumulate in the ecosphere, (3) the physical processes and diversity within the ecosphere must not systematically be deteriorated, and (4) society's use of resources must be efficient and just with respect to meeting human needs (information displayed in a table, p. 109). For each principle, three to five socioecological indicators are presented, described, and discussed. In addition, for each principle an example of empirical analysis using a proposed indicator is provided.

Keywords: Indicators, sustainability, socioecological analysis, human behavior, consumption.

3. **Baechler, G. 1999.** Violence through environmental discrimination: causes, Rwanda arena, and conflict model. The Netherlands: Kluwer Academic Publishers. 319 p.

This book examines the role environmental scarcity and degradation play in the outbreak of violent conflict. The basic premise of the hypothesis is that social conflicts often have material roots related to changes in the society-nature relation brought about by sociopolitical transitions common to economic development. Baechler traces the pathways of social conflict back to their origins to demonstrate the causal relation between environment degradation and violent conflicts. Most of the analysis is on "southern countries" with emphasis and case studies drawn primarily from Africa. The general conclusion is that there is indeed a relation between environmental degradation and social conflict, but the nature of the relation varies with political, economic, and ethnic circumstances. Ultimately, however, environmental security, that is, security of the local life support systems, is a necessary partner to sustainable development such that the demise of the first will preclude the success of the latter.

The book is organized into eight chapters. The first chapter examines transformation and change in society-nature relations and discusses the role of landscape (including water and soil) as the life support system. Baechler suggests that to understand conflict, one must analyze human-induced changes in the landscape and their impacts on the society-human relation. Chapter 2 reviews the literature on environmental security issues and the role of the environment in war and conflict. In this chapter,

the working thesis and research questions are outlined, and methods by which a causal relation between environmental transformation and social conflict can be proved are discussed. Chapter 3 begins with a discussion of the relations among the environment, maldevelopment, and violent conflict and includes a cultural ecological approach to test correlations between specific environmental conditions and violent conflicts. Patterns of conflict are examined, and extenuating and exacerbating factors are explored with concentration on arid lowland and mountainous highland landscapes. A typology of environmentally caused conflicts based on empirical data from the Environmental Conflicts Project is presented and discussed in chapter 4. Analysis suggests that environmental degradation can trigger conflict or exacerbate political, economic, and ethnic conflict to affect behavior. Chapter 5 profiles a case study of Rwanda and explores the causal links between transformation and conflict. A causal model of environmental conflicts based on seven hypotheses is proposed in chapter 6 and then tested against numerous case studies in chapter 7. Finally, chapter 8 summarizes the volume and discusses the interdependence of environmental security and sustainable development.

Keywords: Environmental degradation, conflict, war, environmental scarcity, development, social inequality, discrimination, Africa, Rwanda.

- 4. Barkin, D.; Levins, R. 1998.** The ecosocial dynamics of rural systems. In: Rapport, D.; Costanza, R.; Epstein, P.R. [et al.], eds. *Ecosystem health*. Malden, MA: Blackwell Science: 61-80. Chapter 6.

This chapter discusses the historical and contemporary processes of rural ecosocial systems. Although the discussion does not address the connection between ecosystem health and social system well-being, the use of an ecosocial approach to rural crises analysis is an integrated orientation that considers human needs, cultural survival, and social processes in conjunction with the state of the environment. The primary objective of the chapter is to propose a tool that would change the current trajectory of economic development, which is causing social and natural degradation throughout the world. The chapter begins with a discussion of premodern, rural ecosocial systems including descriptions of food diversity, crop adaptation, labor diversity, food storage, land preservation, variation in food production, population growth, and contacts with the outside world. Premodern, rural ecosocial systems were characteristically dynamic within a range of fluctuation that allowed for environmental and social continuity through time. In contrast, modern rural ecosocial systems, now suffering from debilitating poverty, are facing crisis worldwide. The authors discuss the roles modern economic development and capitalism have played in the ecological and social devastation of the rural ecosocial system including resulting policies that discriminate against the rural poor, unequal access to land, institutional bias against peasants, unequal distribution of income and power, inappropriate employment policies, pressure against local cultural institutions, migration, the feminization of poverty, and urbanization. Barkin and Levins propose that the most viable alternative to the current path of "modernization" would be the development of dual economies in which the local economy is treated as structurally separate from the world economy. This would allow for the empowerment of rural people to reclaim

economic autonomy and allow production systems to be based on local environmental and cultural knowledge. As the development of this system would be socially and spatially specific, local cooperation in planning is crucial. A list of factors to be considered in the development of a dual economy plan is included.

Keywords: Ecosocial systems, development, rural crisis, cultural survival, cultural and social impacts, dual economies, modernization, rural sociology.

5. **Bennett, J.W. 1993.** Human ecology as human behavior: essays in environmental and development anthropology. New Brunswick, NJ: Transaction Publishers. 357 p.

Bennett focuses on contemporary environmental dilemmas and argues for an anthropological orientation in constructing approaches to understanding and addressing such dilemmas. He suggests that ultimately the quality of human life must be related to the quality of the environment, and both must be considered and reflected in policy. In addition to his discussion about environmental dilemmas, he considers the historical, current, and potential roles of anthropology in approaching environmental problems throughout the book. The volume includes 11 chapters divided into 3 sections. All but two of the chapters are edited versions of previously published essays.

The first section addresses concepts and theory. The three theoretical concepts on which most of the arguments are based are ecological transition, socionatural system, and adaptation. Ecological transition focuses on the changes in the relation between humans and nature. Socionatural systems are systems involving both nature and culture and that are constructed and perpetuated in the social sphere. All ecosystems in the world in some way play a role in the social system (be that a role of production or reserve)—and therefore are subject to culturally assigned meaning. The author warns that this concept does not involve the theoretical construction of social and natural versions of the same set of systems properties (i.e., that these two systems are not versions of the same functional system). He argues such a construction would not be effective because the processes of and change in each are driven by different mechanisms at different scales. Bennett also points out that since the industrial revolution, it is the social sphere that dominates natural phenomena—often in a way that promotes degradation in both the social and natural domains. Finally, focusing greater attention on adaptation—changes in behavior to cope with changed circumstance—would shift the orientation of environmental research onto human behavior and ensure a needed emphasis on norms and institutions.

The second section profiles various field studies of resource management that focus on the social conditions of resource conservation, use, and allocation. Chapter 5 discusses local forest resource management in the context of an economy based on “familial-feudal” organization in Japan. In this chapter, the changing social and historical circumstances surrounding forestry are examined as catalysts of change from what may have been a sustained-yield system based on a conservation ethic to an unsustainable increase in harvesting practices. In chapter 6, physical and institutional constraints on farmers’ behavior in Saskatchewan are analyzed, and the relations among social organization, cultural values, and natural substances are discussed. The common property system of the Hutterian Brethren of western Canada

is examined in chapter 7. Implications for common property regimes and sustainability drawn from the case study on the Hutterian experience are outlined and discussed.

The third section includes literature reviews and field surveys of different types of resource management. Literature reviews include "Cultural Ecology and Management of Water Resources" (literature to the 1970s) and "The Changing Socionatural System of Migratory Pastoralism in Eastern Africa" (literature to the 1980s). A survey of issues and problems on adaptations by tribal and modern populations to the North American Great Plains and other arid and semiarid lands makes up chapter 9. In the final chapter, ecophilosophy is described as the belief or worldview that environmental phenomena are as important as phenomena associated with humans.

Keywords: Anthropology, environmental degradation, human ecology, social system, natural system, ecological transition, socionatural system, adaptation, ethics, Japan, Saskatchewan, Hutterian.

6. Berkes, F. 1999. Sacred ecology: traditional ecological knowledge and resource management. Ann Arbor, MI: Taylor and Francis. 209 p.

The field of traditional ecological knowledge emerging since the 1980s is, according to the author, indicative of two things: the need for ecological insights from indigenous practices of resource use, and the need to develop a new ethic, in part by learning from the wisdom of traditional knowledge holders. These ideas are presented together with an emphasis on the dynamics of relations between societies and their resources. The book is organized into three parts that deal with concepts, practices, and issues.

Part 1 includes the context and development of traditional ecological knowledge. Its significance is discussed both for indigenous cultures and, more broadly, for humankind. The intellectual roots of the discipline are in ethnobiology and human ecology.

Part 2 presents material on how traditional ecological knowledge and management systems work. Chapter 4 provides an international context for the practice of traditional knowledge, including one on an indigenous society living in the eastern subarctic of North America. This section describes the Cree system of hunting and in particular how the Cree learned to deal with the experience of declining caribou. A detailed analysis of the Cree system of fishing practices and how it is interpreted by resource management science is presented.

Part 3 includes discussion on (1) how local knowledge develops (cases are from the West Indies), (2) the challenges of adapting traditional systems to modern contexts, and (3) political ecology of indigenous knowledge and learning from the perspective of traditional knowledge and resource management.

Keywords: Human ecology, social systems, natural systems, integration, social change, case studies, James Bay, traditional knowledge, resource management, adaptive management, social learning.

7. **Berkes, F.; Folke, C., eds. 2000.** Linking social and ecological systems: management practices and social mechanisms for building resilience. Cambridge, England: Cambridge University Press. 459 p.

Berkes and Folke analyze social and ecological links in selected ecosystems by using an international and interdisciplinary case study approach. This volume links social and natural systems and reports cases that indicate successful adaptation or learning, and describes management practices and social mechanisms that respond to resource and ecosystem change.

The volume is organized into four parts. Part 1 addresses different approaches to learning from locally devised systems—a “traditional” system from India, an historical system from Europe, and a contemporary system from Europe. Part 2 deals with the emergence of new adaptive systems—two from the Americas and one from Africa. These case studies show how institutions adapt to local ecosystem characteristics and provide an understanding of some of the processes in socioecological systems undergoing change. Part 3 focuses on regional as well as local experiences, and discusses state of knowledge and major generalizations that emerge from the body of literature from four regions of the world. The point made is that local social systems are not isolated but are influenced by regional and national behavior and conditions. Part 4 addresses the question of designing new approaches to management either by exploring ways to combine local and scientific knowledge or by combining traditional and conventional resource management systems.

Keywords: Social systems, natural systems, social ecology, social and ecological resilience, integration, institutions, ecological knowledge, Europe, Africa, South America, North America.

8. **Boyden, S. 1992.** Biohistory: the interplay between human society and the biosphere, past and present. Man and the biosphere series, volume 8. Paris, France: United Nations Educational, Scientific and Cultural Organization. 259 p.

This book is Volume 8 in the “Man and the Biosphere Series” (MAB) sponsored by the United Nations Educational, Scientific, and Cultural Organization. The aims of the MAB program are to address the challenges associated with the use and conservation of resources and resource systems and to address the problems of human settlements. Rather than striving for a multidisciplinary approach to social and environmental dilemmas, the MAB program aims at developing integrated approaches with equal partnership between the natural and social sciences. This volume introduces and explains the concept of “biohistory” and offers a biohistorical perspective on contemporary dilemmas found in the interplay between cultural and natural processes. Rather than a conceptual framework integrating biophysics, sociology, and economics, biohistory is introduced as an educational theme, that allows for a greater integration of human situations and subjective human experience into our understanding of the relations between cultural and biophysical variables.

The book is loosely organized into four sections: biohistorical perspective of Earth (chapters 1 through 5), the causes and effects of societal activities (chapters 6 through 8), the interrelations between humans and society (chapters 9 through 11),

and a biohistorical perspective on our present situation and future conditions (chapter 12). In addition to the substantive chapters, a thorough introduction discussing the meaning and perspective of biohistory is provided as well as two appendices containing a list of variables in which to assess health, and a glossary.

Chapter 1 describes the components of planet Earth, life processes, and life and mineral cycles. The concepts of healthy and unhealthy ecosystems are introduced, and a list of the health needs of an ecosystem is provided. Boyden defines a healthy ecosystem as one “in which the annual rate of bioproduction is more or less constant (or increasing) and an unhealthy ecosystem is one in which it is declining” (p. 25). Chapter 2 looks at the evolution of living organisms, and chapter 3 discusses the diversity and uniformities among living organisms that are results of the natural processes of evolution. Chapter 4 discusses the arrival of humans on Earth and the development of communication leading to the emergence of culture. In addition, social organization and fundamental biological characteristics of the human species are discussed and the basic health needs of humans are outlined. Chapter 5 discusses the domestic transition of humans and the deliberate and systematic manipulation of biological systems for human needs. The remaining chapters examine two primary topics: (1) the relation between the biosphere and society and (2) the relation between humans and society. Conceptual frameworks and explanations of each theme are provided. Chapters 6 through 8 explore classes of societal activities—farming, technological development and the metabolism of society, and warfare and weaponry. Chapter 9 addresses societal organization of human population and looks at the current and future hazards of Earth’s large human population. Chapters 10 and 11 examine the historical relation between humans, as biological beings, and the societies in which they live. Chapter 12 provides an assessment of our current situation, discussion of some of the most pressing challenges to society, and finally the author’s biohistorical opinion on the essential characteristics of an ecologically balanced and desirable society of the future.

Keywords: Biohistory, natural resources, societal behavior, cultural meaning, human-environmental interaction, overpopulation, Man and the Biosphere program.

- 9. Bradley, D.P. 1993.** What would an ecological economics actually do to integrate ecosystems and social system health? A spectrum of approaches. In: *Forestry and the environment—economic perspectives*. Edmonton, AB: Forestry Canada, Northern Forestry Centre: 155-170.

In this article, Bradley discusses the subfield of ecological economics and its role in developing understandings of how ecosystem and social system health are intertwined. To begin, Bradley introduces the central role of values and highlights the limits in our understanding of system dynamism and complexity. He suggests that developing more accurate definitions of ecosystem and social system health is a key responsibility of the ecological economic world view. Key concepts including ecosystem health, social system health, a more integrated concept of health, and the productivity of nature are discussed, and areas that require further conceptual development are presented. In addition, Bradley lays out some of the theoretical foundations of ecological economics, outlines significant contributions and conceptual

advances, and profiles research that is currently being conducted. The key foundations outlined are (1) general economic theory, (2) physics and thermodynamics, (3) ecosystems, (4) ecosystem-economic system interaction, and (5) policy studies and proposals.

Keywords: Ecological economics, ecosystem health, social system health, interaction, integration.

10. Bromley, D.W., ed. 1992. Making the commons work: theory, practice, and policy. San Francisco, CA: ICS Press. 339 p.

This volume evolved out of a conference held in Annapolis, Maryland, in 1985 in which anthropologists, economists, ecologists, sociologists, and political scientists participated in a panel on common property resource management. The collection of papers explores the conceptual, empirical, and theoretical implications of managing common-pool resources (CPRs). The authors use the terms common property regimes and common-pool resources to signify the relation between resource extractors and natural resources. Common property regimes emerge where the costs of exclusion of resource extractors are high and subtractable resource units exist. The stock of a CPR may be used jointly, but services flowing from that stock are individually consumed. This is distinct from an open-access system, where there is unrestricted access and no property rights have been assigned. The book offers theoretical and empirical accounts to coordinated or organized strategies for management of CPRs.

The book is organized in three parts. In the first part (chapters 1 through 3), conceptual information about common property regimes, how they are defined, when they might emerge, and what are some of the common fallacies associated with them are presented. Common concepts and relations in a framework for the physical attributes of the commons, the rules that structure individual and collective choices, the patterns of behavior and interaction, and the resulting physical and social outcomes are identified in chapter 3.

The second part of the book uses Oakerson's framework (chapter 3) to structure an empirical analysis of cases of CPR management. Chapters 4 through 11 comprise eight case studies that depict how communities can govern commonly owned natural resources effectively, without the need for privatization or government management. Through a blend of historical and contemporary cases, the authors present CPR management of a single resource or multiple resources from a range of settings, including Japanese common lands, Andean and medieval English common fields, Turkish and Brazilian fisheries, south Indian village land, and Moroccan grazing commons.

The final part of the book places the case-study material in context and offers some theoretical development about common property resource regimes. David Feeny (chapter 12) identifies research needs and suggests that the relation between the social and physical sciences must be considered when testing the effectiveness of institutional arrangements for common property management. In the last chapter,

Elinor Ostrom culls from the book's case studies and her own research the key variables that relate to the attributes of common pool resources, the relation between use and supply, and the attributes associated with the emergence of what she refers to as appropriator organizations.

Keywords: Common property resources, common property regime, resource management, commons, institutions, forestry, fisheries, grazing, irrigation.

11. Butz, D. 1996. Sustaining indigenous communities: symbolic and instrumental dimensions of pastoral resource use in Shimshali, northern Pakistan. *The Canadian Geographer*. 40(1): 36-53.

Butz suggests that discussions based on the relatively new concept of community sustainability have taken a narrow focus on economic and ecological interactions and have failed to consider the symbolic relation between communities and shared meanings of place. This article studies the role of instrumental and symbolic considerations of Shimshali livestock herders in northern Pakistan, and how those considerations are weighed into Shimshali decisions of resource use. The author finds that it is the instrumental concerns that motivate Shimshalis toward the consumption of resources, whereas symbolic concerns (geared toward the conservation and reproduction of meaning) motivate the Shimshalis to conserve pastoral resources. Household, pasture cycle, and community levels of decisionmaking methods are presented and discussed in terms of the concerns that influence pastoral decisions at each level. A brief summary of predominant themes in the local folklore is presented including the symbolic rationale for the Shimshali's commitment to herding and pastoral life. The author introduces two development schemes presented to the community by outside parties and discusses how the proposals are limited to an instrumental view of resource use and fail to consider the symbolic nature of the natural resources in question. In summary, Butz's research suggests that community sustainability is as related to social and cultural persistence as it is to economics and ecology, and a conceptualization that engenders the social meaning of place for the community will be best equipped to appeal to indigenous motivations for conservation.

Keywords: Social meaning, place, community capacity, natural resource use, cultural reproduction, Pakistan.

12. Cole, D.C.; Eyles, J.; Gibson, B.L. 1998. Indicators of human health in ecosystems: What do we measure? *The Science of the Total Environment*. 224: 201-213.

Cole and others review different perspectives and relevant data on indicators of the interaction between ecosystem and environmental conditions with human health and social well-being. Definitions and uses of indicators in different environments and health-related fields are discussed in terms of developing environmental models, measuring human health, and assessing well-being and sustainability. Six scientific criteria for indicators are presented and discussed. These criteria include data availability, indicator validity and reliability, indicator responsiveness to change, indicator desegregation capability, and indicator comparability. Methods and indicators used

to assess human exposure to environmental pollution, human mortality and morbidity, and sustainability are analyzed, and disciplinary as well as scientific constraints to effective indicator use are discussed. The authors argue that natural scientists, health scientists and practitioners, as well as social scientists and planners have made considerable progress in developing and using indicators in their respective fields; however, greater attention must be directed back to the interplay between ecosystems and human health so that policymakers may make better informed decisions that ultimately affect both ecological and social systems.

Keywords: Social indicators, human health, ecosystem health, pollution, measurement.

13. Costanza, R.; Norton, B.G.; Haskell, B.D. 1992. Ecosystem health: new goals for environmental management. Washington, DC: Island Press. 269 p.

A group of disciplinary specialists including ecologists, economists, and philosophers discuss principles and conceptual understandings as they relate to health and ecosystems. The theoretical aspects of a healthy ecosystem are described including the implications for public policy and ecosystem management. Part I includes a broad discussion on philosophy and ethics, and Part II encompasses discussions about science and policy. Costanza, in the final chapter, focuses on some of the operational definitions of ecosystem health, addresses both advantages and disadvantages, and suggests how these definitions may be put into practice. The authors also suggest a general index of system health made up of a combined measure of system resilience, balance, organization (diversity), and vigor.

Keywords: Ecosystem health, systems theory, science and policy, philosophy and ethics.

14. Crumpacker, D.W. 1996. Conservation biology and U.S. Forest Service views of ecosystem management and what they imply about policies needed to achieve sustainability of biodiversity. NRLC Public Land Policy Discussion Paper Series PL03. Boulder, CO: University of Colorado, Natural Resources Law Center. 53 p.

Crumpacker examines the views and definitions of ecosystem management from the perspectives of conservation biologists, the USDA Forest Service, and others. In this discussion, the concepts of integrity, health, natural and native, and their application to ecosystem management are explored. Plans to attain a viable system for ecosystem management are introduced, and circumstances that limit the full application of these strategies are discussed. The plans for ecosystem management that are given particular attention are reserve networks, which have been initiated in the Wildlands Project, and adaptive ecosystem management regimes proposed by the USDA Forest Service. The author argues that both strategies are biocentric in their vision and would require too large of a geographic area to meet their conservation goals. As an alternative, the author argues that ecosystem management needs to be integrated into human communities because the current importance placed on ecosystem management is born from societal values concerning preservation. He suggests that commodity-development and biodiversity interests may be able to "find some common ground in a shared land ethic" (p. 42) and that this ethic may be

achieved through the combination of scientific data and human values. The Man and the Biosphere Program and the Keystone Initiative are presented as community efforts toward these ends.

Keywords: Ecosystem management, management goals, social values, natural resources, sustainability, conservation, biology, biodiversity, USDA Forest Service, Man and the Biosphere Program, Keystone Initiative, U.S.A.

15. Daly, H.E.; Townsend, K.N., eds. 1993. Valuing the Earth: economics, ecology, ethics. Cambridge, MA: MIT Press. 387 p.

Twenty classic and contemporary essays that place economic growth in context with ecological and ethical constraints and considerations are presented. The collection of essays continues several decades of work by Herman Daly and others to solidify the steady-state economy paradigm within the field of economics. The objective is to depict various points of view surrounding the issue of whether a healthy economy has to be a growing economy, and if it is constantly growing, describe the implications. The collective conclusion, as depicted by most authors and the editors, is that economic growth is both physically and economically unsustainable, as well as morally undesirable.

The editors organized the essays into three sections on ecology, ethics, and economics, and provided introductions to each section. Seminal works written several decades earlier and recent essays reflecting the evolution of thinking are included. The first section focuses on ecology by considering issues of human population and technology in the context of sustained growth. Paul Ehrlich, Anne Ehrlich, John Holdren, Nicholas Georgescu-Roegen, M. King Hubbert, and Garret Hardin contributed to this first section. In the second section, E.F. Schumacher, Gerald Alonzo Smith, John Cobb, and C.S. Lewis address the issue of morality. The authors describe the various ethical dilemmas in a world where consumption goes unchecked against the needs of future generations and the capacity of the natural world to sustain this consumption. In the third section, essays by Herman Daly, Kenneth N. Townsend, Kenneth E. Boulding, and Thomas Tietenberg address the reciprocal impacts of human economy and ecological systems, the prevailing use of gross national product as a measure of economic health, and the power of economic incentives, such as taxes and subsidies, to direct market forces.

Keywords: Ecological economics, environmental ethics, morality, economic development, sustainable development, steady-state economy.

16. Dasgupta, P. 1993. Poverty and the environmental resource base. In: An inquiry into well-being and destitution. New York: Oxford University Press, Inc: 269-296.

Dasgupta explores the concept of human well-being and the state of social well-being through an analysis of its opposite—ill-being and destitution. The primary object of analysis is the political policy level, which is related back to the state of well- or ill-being for individuals and families. Attention is directed toward nutrition

and human health with less of a focus on the effects at higher levels of social organization. Explanations are grounded in empirical evidence with examples primarily drawn from poor rural communities in Asia, Africa, and Latin America. Dasgupta uses an economic theory approach in his analysis and takes full advantage of the discipline's recent renaissance in the use of sociological and anthropological theory, methods, and analysis. The book was intended for readers from various disciplines, and the theories and assumptions of analysis are explicitly stated resulting in a thorough, however long text. Citations with great detail are provided in the text and footnotes. The product of the analysis is a discussion of the fundamental commodity needs of people, the role of the state in the allocation of those benefits and resources, and the genesis of a resource allocation theory.

Dasgupta suggests that the neglect of the relation between social well-being and ecosystem health may be the only common thread in 40 years of literature on poverty and development economics (p. 273). The relation between society and natural resources is discussed in chapter 10 in which the relation between poverty and the environmental resource base is explored. This chapter examines the ecological links between poverty and resource degradation. Dulled private incentives in agricultural investment, lack of knowledge of development economics, neglect of the relation between poverty and resource degradation, misuse of renewable resources, and the negative effects of misplaced incentives to increase rural production are cited as factors that lead to extreme degradation of a community's natural resource base and the perpetuation of its state of destitution. Degradation of the resource base typically has greater consequences for women and children and may strongly deteriorate the well-being of some sections of society even while the economy, on average, grows. Resource needs and stress are quantitatively analyzed, and the concept of carrying capacity is introduced. In addition, market failure, institutional biases in project evaluation, blind devotion to increasing net national product, and insecure land tenure rights are all discussed as factors that perpetuate rural poverty, and the success and failures of common property resource systems are analyzed. Two points emerge from this exploration: (1) attempts at rural development must consider a wider range of economic and ecological interactions, consider the welfare of the poorest individuals, and use longer temporal scales; and (2) there appears to be a close link between environmental protection and the well-being of the poor.

Keywords: Social conditions, ill-being, policy, ecosystem health, poverty, developing economies, environmental resources, social scale, environmental protection, social well-being.

17. De Leo, G.A.; Levin, S. 1997. The multifaceted aspects of ecosystem integrity. *Conservation Ecology*. 1(1): 3. <http://www.conservor.org> (June 2002).

De Leo and Levin address the relation among biodiversity, ecosystem function, resiliency, and both natural and anthropogenic forms of disturbance to contribute to a more effective approach to ecosystem management. To begin, De Leo and Levin examine what they perceive as the overused notion of ecosystem health and review its limitations as an organizing concept for ecosystem management. They suggest that a better approach to ecosystem management would focus on processes of ecosystem functioning (rather than states as in ecosystem health analysis) and

emphasize dynamism, variability, spatial heterogeneity, and nonlinear causation. As opposed to ecosystem health, they propose that this would be an “ecosystem integrity” approach that could serve as a conceptual tool to help scientists and resource managers grasp the complexity of biological systems. The authors argue that the best methods for analyzing and assessing ecosystem integrity would draw from both structural and functional approaches and link biodiversity and ecosystem properties. Rather than a monolithic concept, ecosystem integrity would be a multi-dimensional, scale-dependent abstraction that would allow for analysis at different organizational levels and for differing subjective needs of humans. Keystone species and functional groups are discussed as starting points from which to assess species composition and biodiversity. In addition, the role of ecological redundancy is introduced and related to ecosystem stability and resilience. Discussions on adaptive management and temporal scales of change also are presented, and an argument against the economic valuation of natural systems is outlined. Bibliography and appendices are included.

Keywords: Ecosystem management, ecosystem integrity, philosophical orientations, ecosystem assessment, ecological redundancy, stability.

18. Di Giulio, R.T.; Monosson, E., eds. 1996. Interconnections between human and ecosystem health. [Ecotoxicology Series 3]. London: Chapman and Hall. 275 p.

The primary, and much reiterated, aim of this book is to open the lines of communication between social and natural specialists and nonspecialists on the subject of the connectedness of human and ecosystem health. The volume is divided into six parts and also includes an introduction and synthesis chapter. In the introduction the terms “ecosystem health” and “human health” are discussed. Even though the term “ecosystem health” has many cited shortcomings as an organizing concept, the authors opted to keep it and allow individual contributors to define how they, according to their respective disciplines, defined it. Part 1, “Mechanistic Linkages,” deals with the interconnections between humans and ecosystems at the subcellular or molecular levels. In part 2, two chapters profiling studies on the human and ecosystem links at the ecosystem or landscape level are included. Here, the analysis is graduated from the subcellular level to the links between humans and affected ecosystems. Part 3 examines the role of ecosystems in maintaining human health and discusses the hazards of continued degradation of ecosystem recycling processes. Part 4 introduces the importance of human values of the environment and analyzes the sociological and economic values associated with ecosystem products and services. This section includes three chapters on ecological risk assessment. Topics discussed include the implications of applying the human health risk paradigm to ecological risk assessment, a critique of some current ecological risk assessment techniques, and the role of ecological risk assessment in environmental management. Part 5 addresses the socioeconomic and psychological perspectives of the relation between human and ecosystem health. The first chapter in this section deals with economic valuation of ecosystems (or parts of ecosystems) and sets the stage for the discussion of the interconnections between human well-being and ecosystem health. In this discussion, the central role of values is discussed. The next two chapters focus on people’s beliefs and examine the effect of perceptions

of ecological risk and ecosystem health on human well-being. Part 6 contains two chapters analyzing the representations of the environment in fiction and nonfiction works to help illuminate our relation with the environment. An index is included.

Keywords: Ecosystem health, human health, interconnections, risk assessment, pollution, environmental degradation.

19. Dunn, J.E. 1997. Responding to pressure on local natural resources: the story of three villages in south-eastern Nigeria. *Journal of Environmental Management*. 51(4): 361-371.

This paper analyzes the social adaptive responses of three villages in southeastern Nigeria to changing social and ecological conditions. Whereas contemporary “scientific” solutions to problems caused by social and ecological change have had limited success, development personnel have turned toward a greater reliance on the local ability to adapt to changing circumstances. The author maintains that even though communities historically have adapted to socioeconomic and ecological change, current conditions may be changing at a rate that does not allow for the successful adaptation of local people in time to prevent widespread environmental damage. Changing socioeconomic and environmental conditions are analyzed for the villages of Abo Mkpang, Igonigoni, and Obiokpok in Nigeria. Changing local conditions include growing “land hunger” owing to natural population growth as well as immigration, shorter farming rotations and consequent soil deterioration, and increased activities of the national forestry agency. Findings indicate that in Obiokpok, where change has moved at a comparatively slower pace, an ecologically sound farming system seems to be developing. In Igonigoni, where change is occurring at a faster rate, and in Abo Mkpang, where agricultural land and forest extraction activities were suddenly limited by the establishment of a national reserve, the development of social institutions to mitigate negative environmental impacts has not been able to keep pace with changing circumstances. In conclusion, the author suggests that in situations where environmental change occurs rapidly, catalysts or accelerators may help adaptation take place before serious ecological damage occurs.

Keywords: Human adaptation, environmental change, socioeconomic change, rates of change, Nigeria.

20. Eder, J.F. 1990. Deforestation and detribalization in the Philippines: the Palawan case. *Population and Environment: A Journal of Interdisciplinary Studies*. 12(2): 99-115.

Eder studies the relation between deforestation and well-being of upland Palawan tribal members in the Philippines. Decline in social and economic well-being as well as deforestation have been widely observed in the Philippines. Agroforestry projects have been proposed and implemented to enhance the income of indigenous tribes while aiming to promote ecologically sustainable agricultural practices. Eder argues that the success of such agroforestry projects is severely hindered in both their social and ecological objectives because the government denies tribal people land tenure rights despite their long histories of residency. Eder maintains that detribalization and socioeconomic marginalization of the Batak is the combined result of commercial logging and uncontrolled immigration of land-hungry migrants from the lowlands.

The concept of “detrribalization” is presented and tied directly to insecurity of land tenure. Eder draws the connection between the ways in which people make a living and their culture to illustrate that a continued lack of land tenure will cause greater marginalization of the tribe and continued cultural erosion. The conclusion is that secure land tenure is crucial to halt deforestation and detrribalization on the island of Palawan.

Keywords: Deforestation, cultural preservation, detrribalization, land tenure, Palawan, Philippines.

21. Firey, W.I. 1960. Man, mind, and land. Glencoe, IL: The Free Press. 256 p.

Firey develops a theory of natural resource use to help illuminate the necessary conditions for successful resource and land use planning. Written before academic discourse on ecosystem health and social system well-being emerged, the author addresses the necessity of equilibrium suggesting that the stability of one system is dependent on the stability of the other. The first chapter introduces the author’s line of reasoning, the basic premises on which the arguments are based, and the operational definitions of terms. Here the concept of a resource system is introduced as a man-mind-land structure of which there are two categories: (1) the resource complex, a stable system by which man has impetus for conforming his behavior to custom; and (2) a resource collection, which has no impetus or organization and which, therefore, lacks stability. In chapter 2, Firey addresses three subsets of knowledge that address the use of natural resources—the ecological, ethnological, and economic. Each field is discussed in terms of the knowledge it can contribute to determining successful resource planning. The author develops arguments based on these fields of knowledge and tests new hypotheses with empirically based examples in chapters 3 through 7. Chapter 3 looks at Niv resource systems in Nigeria. Chapter 4 examines the slash and burn resource systems of northern Rhodesia and, to a lesser extent, Africa. In chapters 5 and 6, Firey illustrates that there is some degree of adaptability on the part of the individuals involved in a resource system and that resource systems can change over time in response to exogenous factors. The example cited in this case is the open-field farming complex of the medieval English Midlands. In chapters 7 and 8, he further addresses the necessary conditions of resource development and conservation through an exploration of the experiences in the high plains of North America. Chapter 9 also reflects on the north and south plains of America and discusses the roles of physical and cultural stability in the social environment, and vice versa. The concluding chapter concentrates on the role of consent in natural resource policy and the relation between a resource system and culture. The book includes an index.

Keywords: Resource use, land use, stability, cultural stability, environmental degradation.

22. Force, J.E.; Machlis, G.E. 1997. The human ecosystem. Part II: Social indicators in ecosystem management. *Society and Natural Resources*. 10: 369-382.

Force and Machlis introduce the concept of social indicators and discuss their possible utility in ecosystem management. A conceptual framework of a human ecosystem featuring both critical resource inputs and the human social system is presented and

discussed. The authors note that social indicators have not been fully taken advantage of in research on natural resource use and discuss several possibilities in which social indicator research could offer land managers valuable information. Some benefits of knowledge of social indicators in ecosystem management include the following: (1) they offer a means of comparing across counties within ecoregions, (2) their analysis between ecoregions can help determine if circumstances are unique to a given ecoregion, (3) if data are available over time, they can serve to illuminate the relation between the human ecosystem and land management decisions, (4) their analysis may help project potential concerns or predict risks in the future, (5) they can allow for the monitoring of human ecosystem responses to management decisions, and (6) their use can help managers (and others) establish priorities. Perspectives on both the strengths and weaknesses of social indicators are discussed as well as the importance of appropriate scales. An example case study of the upper Columbia River basin is presented in which county-level data were collected for 39 social indicators.

Keywords: Conceptual framework, social indicators, ecosystem management, upper Columbia River basin.

23. Hanna, S.S.; Folke, C.; Maler, K., eds. 1996. Rights to nature: ecological, economic, cultural, and political principles of institutions for the environment. Washington, DC: Island Press. 298 p.

This book is a product of a research program titled "Property Rights and the Performance of Natural Resource Systems" by The Beijer International Institute of Ecological Economics (The Beijer Institute). The Beijer Institute strives to increase the knowledge of links between economic systems and the ecological systems on which they are based. This book deals broadly with the relation between nature and humans and how humans use nature to meet their needs and desires. The particular objects of study are the socially generated systems of rights and institutions by which human-environmental interactions are regulated, specifically property-rights systems. The book is divided into four parts: (1) the interface between social and ecological systems; (2) the structure and formation of property rights; (3) culture, economic development, and property rights; and (4) property rights at different scales. The remainder of this annotation is on part 1—the relation between social and ecological systems.

In the first chapter, Robert Costanza and Carl Folke argue that in order to reach sustainability, human processes, including property-rights regimes, must be consistent with characteristics of the ecological systems with which they are related. Some basic characteristics of ecosystems are discussed, and examples of sustainable ecosystems are presented as models for the development of sustainable human systems. The second chapter, by Susan Hanna and Svein Jentoft, addresses the social and economic properties of human uses of ecological systems. They argue that institutions are based on social values and, therefore, social values define the character of human-ecosystem interactions. The third chapter in this section, by C.S. Holling and Steven Sanderson, looks at some key features of ecological systems and argues that human management systems are not congruent with the basic

organizational nature of ecosystems. The final chapter of Part 1, by Fikret Berkes, examines how natural resources and social systems interact under different property-rights regimes. Berkes reviews literature on common property resource systems and suggests that maintaining diversity, flexibility in management, and greater sensitivity to feedbacks in common property resource management regimes would lead to more sustainable use of natural resources. An index is included.

Keywords: Ecological economics, human-environmental interactions, property rights, institutions, social values, common property resources, management, the Beijer Institute.

24. Hodge, T. 1997. Toward a conceptual framework for assessing progress towards sustainability. *Social Indicators Research*. 40(1-2): 5-98.

This paper represents a detailed review of literature in which Hodge originally aimed to identify an existing conceptual framework that could serve as a guide for reporting on progress toward sustainability. Specifically, the author set out to identify a model of the human-ecosystem interface that could be used by decisionmakers and that could satisfy five criteria: (1) the components and their relations are adequately defined, (2) the value base underlying the concept of sustainability is reflected, (3) the model includes a systematic approach to describing human-ecosystem interactions in which both the individual components as well as the whole system can be understood, (4) the physical system and its relation to the human decisionmaking process are accurately described, and (5) the model easily leads to an organizational framework for assessing progress toward and reporting on sustainability. In this paper, 29 human-ecosystem models are described and examined including 11 "social-economic-environmental" models, 3 models from economics literature, 3 stress and stress-response models, 2 general ecological models, 4 models from the sustainable development and sustainability literature, the model reflected by the AGENDA 21 macro structure, and 5 miscellaneous models. Hodge concludes that although each model contributes useful insights toward the needed framework for assessing sustainability, none of the 29 models reviewed satisfies the above-mentioned five criteria. Other conclusions drawn from the review include the recognition that many factors are involved in the ecosystem-people interface and need to be treated systematically in order to avoid confusion, values play a critical role in those links, few of the existing models have an equal concern for both people and ecosystems, and there has been little effort in understanding the multiple roles human activities play at the human-ecosystem interface. Hodge proposes, describes, and explains a conceptual approach that draws from the philosophical overlaps among many of the models he reviews. The approach proposed allows for four types of information that can be used to assess progress toward sustainability and help meet the five criteria listed above: (1) information on the integrity and health of the ecosystem, (2) information on the well-being of people, (3) information on the interaction of ecosystems and people, and (4) data and information on emergent systems properties of the human-ecosystem interactions.

Keywords: Sustainability, conceptual models, sustainable development, assessment, criteria and indicators, Canada.

- 25. Homer-Dixon, T.; Blitt, J., eds. 1998.** *Ecoviolence: links among environment, population, and security*. Lanham, MD: Rowman and Littlefield Publishers. 238 p.

This book explores the links between environmental scarcity and social violence. The research for the book emerged from the "Project on Environment, Population, and Security" (EPS), based at the University of Toronto, which aimed at studying the causal processes and links among population growth, renewable resource scarcities, migration, and violent conflict. The book includes five cases on Chiapas, Mexico; Gaza; South Africa; Pakistan; and Rwanda. Each case study provides an overview of the situation, background information on the context, and a discussion of the environmental scarcity in the region. In addition, the authors discuss what role environmental scarcity may have played in instigating or exacerbating the circumstances that led to social violence. Eight unifying themes and key findings of the compilation are identified. First, scarcities of renewable resources may lead to civil violence, but most often generate intermediate social conditions, such as poverty and migration, which are accredited with leading to civil violence. Second, environmental scarcity is caused by the compounded effects of the depletion of, increased demand for, and unequal distribution of renewable resources. Third, environmental scarcity encourages resource capture by those with political power, and migration to more ecologically sensitive areas by those who are politically marginal. Fourth, economic development will be constrained and migration will be encouraged if populations are unable to adapt to resource scarcity. Fifth, without successful adaptation, resource scarcity will lead to greater social segmentation and sharper distinctions among social groups. Sixth, environmental scarcity can reduce the power of governmental institutions and states and make their jurisdictions more susceptible to corrupt actions of elites. Seventh, all of the aforementioned consequences of environmental degradation—constrained economic productivity, population movements, social segmentation, and weakening of institutions and states—can lead to acute social crisis and widespread civil violence. And finally, eighth, the conflicts and crisis can have widespread impacts on the international community. An index is included.

Keywords: Renewable resources, resource scarcity, deforestation, environmental degradation, social impact, violence, civil unrest, Chiapas, Gaza, South Africa, Pakistan, Rwanda.

- 26. Hytonen, M. 1998.** The concept of social sustainability of forestry. In: Hytonen, M., ed. *Social sustainability of forestry in the Baltic Sea region*. The Finnish Forest Research Institute, Research Papers. 704: 9-44.

In this paper, Hytonen maps trends in development literature and in the conceptual understandings of the social sustainability of forestry. A survey of the concepts related to socially sustainable forestry including sustainable development, social sustainability, and sustainable forestry is provided. For each of these concepts, the circumstances surrounding its development and the problems each was designed to address also are discussed. Examples of the most widely used definitions and the application of those definitions to development projects by national and international agencies are provided. After the discussion of abstract definitions and conceptual understandings, examples of their use in the promotion and study of social sustainability of forestry in the U.S.A., Russia, and Finland are discussed. The historical and current political, economic, and social conditions of each geographic area

result in different perspectives and applications of socially sustainable forestry practices. The specific examples cited from the U.S.A. are the concepts of New Forestry, the Forest Ecosystem Management Assessment Team, and the Interior Columbia Basin Ecosystem Management Project. For northwest Russia, the limitation of social sustainability in forestry by current political and economic circumstances is discussed. Hytonen suggests that the Finnish model of forestry has historically been more socially sustainable because it places emphasis on the living condition of rural people and social acceptance of forestry practices. A brief description of the circumstances under which the terms “community forestry” and “social capital” were introduced into the development vocabulary, a discussion of the central components to these concepts, and examples of how they have been applied also are presented as instances where socially sustainable forestry concepts can be applied to alleviate specific social problems. As a conclusion to this survey, Hytonen suggests that there is a broad scope of concepts with which to approach social challenges associated with forestry, but there is a dearth of analytical and practical methods by which to mitigate those challenges. An extensive bibliography is included.

Keywords: Forestry, sustainable development, social impacts, social forestry, social well-being, place, Finland, northwest Russia, U.S.A.

27. Jamieson, D. 1996. Sustainability and beyond. NRLC Public Land Policy. Discussion Paper Series PL02. Boulder, CO: Natural Resources Law Center. 17 p.

This paper is primarily concerned with the term “sustainability” and how it serves to unite different constituents into a common language, represents concerns for both well-being and the environment, and provides a conceptual approach to fulfill objectives derived from various social values. To begin, Jamieson differentiates between strong sustainability (SS) and weak sustainability (WS): the former being based on the preservation and protection of natural capital and the latter emphasizing the maintenance of social and human well-being through time. Both types of sustainability are discussed and found to have many limitations. In addition, questions not addressed in either definition of sustainability are introduced including questions of scale, the importance of sustainability, and normative judgments on what should be sustained. The strong role that politics, ethics, and values play in environmental policy is illustrated through a discussion of land-use policy in Colorado. In this example, it is suggested that the concept of sustainability does not bring people to the same conclusion of what should be done; however, it can serve as a common vocabulary to identify the choices and tradeoffs contained within land-use decisions. Jamieson acknowledges the introduction of “ecosystem health” as a policy objective or approach by what he terms “environmentalists” but suggests that the ecosystem concept is likely to be unsuccessful because it ignores ethical and political dimensions of environment disputes. His final conclusions on the utility of “sustainable development” are similar; he argues that instead of a technological or economic fix, a different vision of the appropriate relation between humans and nature must be developed if we are truly to address the environmental crisis.

Keywords: Sustainability, weak sustainability, strong sustainability, natural capital, human-produced capital, environmental ethics, land-use policy, Colorado.

28. Jansson, A.; Hammer, M.; Folke, C.; Costanza, R., eds. 1994. Investing in natural capital: the ecological economics approach to sustainability. Washington, DC: Island Press. 491 p.

Ecological economics is a broad area of study that addresses the interrelations between ecological and economic systems. In this context, a broad view of economics is used to include all aspects of the human system involved with the exchange and appropriation of goods and services, including the social values from which economic value is derived. A central orientating premise to ecological economics is that, ultimately, a healthy economy can only exist if the related ecology is also healthy. The editors suggest that because of its concern for the health and function of both natural and social processes and, therefore, its detachment from traditional disciplinary restrictions, ecological economics is positioned to make valuable contributions to the knowledge necessary for advancement toward sustainable development. This book resulted from a 2-day workshop attended by the invited plenary speakers at the biannual conference of the International Society for Ecological Economics titled "Investing in Natural Capital—A Prerequisite for Sustainability." One purpose of the workshop was to devise an agenda for ecological economics in research, education, and policy. This resulting book presents some of the plenary papers presented at the conference, highlights general themes in the field of ecological economics, and proposes a working agenda for research, education, and policy. The editors suggest that this text would serve well as a graduate-level source book on ecological economics.

The conceptual basis for this volume is well summarized in the foreword: "Investing in natural capital—the life-supporting environment upon which our economic, sociopolitical, and cultural systems depend—is indeed a prerequisite for the economy and for human welfare" (p. xiii). The book includes 26 chapters organized into one introductory chapter and three sections: (1) perspectives on maintaining and investing in natural capital, (2) ecological economic methods and case studies on the significance of natural capital, and (3) environmental management and policy implications: adjusting economic, technical, sociopolitical, and cultural systems. The introductory chapter synthesizes, explains, and discusses some of the themes of the conference and the major ideas contained in the case-study chapters that follow. Basic tenets of ecological economics are presented, and the contributions ecological economics can make toward sustainability are discussed. Topics for further research in ecological economics are proposed, and some general policy recommendations are offered. An index is included.

Keywords: Ecological economics, social values, natural capital, human welfare.

29. Jenkins, T.N. 1998. Economics and the environment: a case of ethical neglect? *Ecological Economics*. 26: 151-163.

The modernist approach in economic development has led to crises in both social and natural environments. In addition, the traditional mechanisms used in contemporary economic development, such as regulatory interventions and market incentives, are unable to prevent or mitigate such crises. This paper discusses whether or not there might be a role for "cultural and spiritual heritages" in the possible development of an environmental ethic that would remedy current and prevent future

environmental and social crises. Jenkins examines contrasting cultural understandings of humanity's relation with nature, the roles these understandings play in the development of an environmental ethic, and to what extent pro-environmental cultural orientations lead to pro-environmental behavior. To begin, the author discusses the dominance of economic prosperity and materialistic individualism in the value system that currently drives international policy and development. Jenkins suggests that an ecologically more realistic view of development would consider both the structural and technological aspects of the system, but also have an inclusive vision of the associated human values and knowledge. A greater understanding of the underlying values that local people associate with nature and an "environmental reverence" on the part of the human actors would allow for more qualitative assessments of development. It is this "environmental reverence," Jenkins argues, that is needed to ensure the development of a land ethic that allows for increases in the quality of life without compromising social and ecological balance. Jenkins suggests that it is within cultural heritages that the seed of environmental reverence may be found.

To illustrate the perspectives presented above, Jenkins provides discussion of the contrasts between traditional Western and Chinese metaphysical relations with the environment. The Western tradition is characterized by its human and cosmic disconnect; its antagonistic, dualistic view of humanity and nature; and a separation of individual from community. By contrast, the Chinese conception emphasizes social interconnectedness, the individual's embeddedness into community, ecological interconnectedness, and a mutual dependency between humanity and nature. However, in spite of strong pro-ecological orientations of some cultures, there still exists a dilemma in which development is linked with social and environmental degradation. Jenkins addresses this dilemma in China, recognizing that in spite of the historical pro-ecological nature of Chinese tradition, social and environmentally destructive processes are now taking place. Four hypotheses that would explain this seeming contradiction are put forth, including discrediting the customary assumption that pro-ecological attitudes will automatically lead to social and ecologically sound behavior. As a solution to the ethical dilemmas like those found in China, Jenkins suggests a new (coevolutionary as opposed to universal) ecological ethic that draws from pro-ecology heritages and allows for effective tools to reach sustainability. A thoroughly referenced discussion of developing ethic paradigms from which a new land ethic could draw inspiration is included. Sixty references are cited.

Keywords: Ethics, cultural heritages, development, Western tradition, Chinese tradition, ecological ethics, sustainability.

30. Jodha, N.S. 1995. Common property resources and the environmental context: role of biophysical versus social stresses. *Economic and Political Weekly*. 30(51): 3278-3283.

Jodha examines the roles of biophysical and social stresses in reduction of common property resource systems. He suggests that an increase in social factors that favor development interventions rather than common property resource (CPR) systems have marginalized the role of community in the management of CPRs and have resulted in the disregard of ecologically and environmentally sound use for more short-term considerations. Data collected over 3 years from 80 villages in dry regions

of India are analyzed to determine how changes in environmental stresses versus social conditions have affected the utility and health of CPRs. The data indicate that historically, villages with more environmental stress have devoted greater areas to CPR systems than areas with less environmental stress. However, despite their usefulness as a collective resource management and risk sharing strategy, the number of CPRs has declined in the dry tropical regions of India since the early 1950s. This decline is attributed to the rise in circumstances that encourage the privatization of former CPR lands including interventions of the state in CPR management, the availability of new farming technology, land hunger coupled with population growth, the collapse of traditional forms of rural cooperation, and increased influence of market forces on the local village economy. This result has been physical land degradation and reduced productivity of CPRs.

Keywords: Development, common property resources, community change, fallow lands, cooperative management, natural resource management, India.

31. Jostad, P.M.; McAvoy, L.H.; McDonald, D. 1996. Native American land ethics: implications for natural resource management. *Society and Natural Resources*. 9: 565-581.

A large part of the literature on Native American belief systems consists of philosophical presentations, case studies, or analysis of secondary sources, and a dearth of understanding of Native American land ethics on the part of federal and state agency resource managers remains. In this study, the authors direct their attention to Native American land ethics as they are experienced and described by a group of Native Americans themselves. An overview of the literature on Native American land ethics is provided and thoroughly referenced. Qualitative methods were used to study traditional Native American beliefs that relate to a Native land ethic for the Menominee Indian Tribe of central Wisconsin and the Salish-Kootenai Tribal Confederation of the Flathead Reservation of northwestern Montana. Fifty-two indepth interviews about traditional beliefs and land ethics were conducted with tribal members, and tribal management plans were analyzed for content reflecting the ethics revealed in the interviews. Results suggest that Native American land ethics are composed of four primary belief areas: (1) All is Sacred (there is no separation between the secular and spiritual), (2) All is Interrelated (everything is interconnected in an egalitarian system), (3) Mother Earth (the Earth is the physical and spiritual mother of creation), and (4) Right Action (individual choice of action is based on the belief system). Each belief area is discussed and illustrated through extensive quotes drawn from the authors' fieldwork. A symbol depicting a Native American land ethic including the four belief areas as well as three fields of human activity (self, tribe, and Earth) is presented. Members of both tribes indicated that components of the traditional land ethic belief systems were incorporated into contemporary tribal land and resource management plans. The authors suggest that the Native American land ethic should be examined for its application to ecosystem management because both are based on the preservation of multidimensional values.

Keywords: Native American, culture, land ethic, resource management, world view, social well-being.

32. Lee, K. 1993. Compass and gyroscope: integrating science and politics for the environment. Washington, DC: Island Press. 243 p.

Lee takes a broad approach to the debate over sustainability, takes stock of the challenges and constraints to achieving sustainability, and then examines the tools already available to address these problems. His analysis broadly addresses the management of natural resources and environmental management and socioeconomic institutions associated with environmentally destructive human behavior. Although sustainability has biological, technological, sociocultural, economic, and ethical dimensions, the paths to attain sustainability, Lee suggests, must arise from human institutions. Lee attempts to address the need for social capacity and learning necessary to understand and move toward resolving the threats brokered by the industrial social paradigm. The tools he sees as being central to success on this front are science and democracy. He suggests science is a tool for assessing the strategies we use to attain sustainability: our way of measuring if we are on the right path. Democracy, negotiated through politics, functions as the social stabilizer, which maintains the dialogue that will ensure that immediate costs and long-term benefits to sustainability are borne equitably. A case study of the Columbia River basin is presented with a critical look at the success and failures of management efforts.

Lee proposes three conditions for sustainability. The first, **equity**, is presently limited by the industrial market system that sacrifices the ecological integrity of the future for immediate market benefits. A lack of a **legacy perspective** of natural resources, which is Lee's second requisite for sustainability, stems from the paradoxical relation between growth and well-being. As economic growth increases so does well-being, until it passes a point where further growth begins to compromise well-being. He argues that the barrier to a legacy ethic is "the socially constructed assumption that growth will continue." The final requisite is **continuity**. Lee proposes that the building of a social commitment to limited growth is largely a political process whereby individuals and countries trust that the risk of forgoing economic benefits in the present will not be negated by others defaulting on the social contract to limit growth. Notes on sources and an index to key terms are included.

Keywords: Sustainability, social capacity, democracy, equity, intergenerational equity, continuity, growth, Columbia River basin.

33. Little, P.D.; Horowitz, M.M., eds. 1987. Lands at risk in the third world: local-level perspectives [Monographs in Development Anthropology Series]. Boulder, CO: Westview Press. 416 p.

This book is based on the proceedings of the conference, "Lands at Risk in the Third World," organized by the Clark University Institute for Development Anthropology (IDA) Cooperative and was held in Binghamton, New York, in October 1985. The conference invitees included social scientists who had conducted long-term fieldwork in various ecological zones on aspects of human-environment relations. The primary objective of the conference was to contribute to the discussion surrounding the relations among the environment, society, and development and to allow for the

exchange of ideas and insights through presentations of local data on ecology and resource management, exploration of different methods, and discussion of what is meant by “environmental risk.”

The general topic of the book is what the editors term the “neglected sector” of agricultural development analysis that includes questions about the roles of social structure, social process, and cultural history in resource deterioration and environmental degradation. The lack of attention to social and cultural processes in agricultural production and household sustenance has left many mystified as to why seemingly good agricultural development projects have exacerbated environmental degradation locally. Through the presentation of case studies, this book illuminates the problems including land tenure, poverty, and ill-advised policies and development programs that have led to continued environmental decline in already ecologically and socially stressed areas of the third world. The book includes a foreword, an introductory chapter, 18 substantive chapters, and an index. The introductory chapter introduces the general theme of the volume, the reciprocal effects of environmental and social well-being, and explains the objectives of both the conference and the book. The historical development of ecological applications of anthropological inquiry is outlined, and the general organizing themes around which the substantive chapters are organized are introduced. General themes include “Models of Resource Management” (section 1), which includes a discussion of several theoretical perspectives on resource management as well as an examination of the critical roles of political variables, human values, and human meanings. Section 2, “The Role of the State,” examines government and donor-funded projects that have resulted in environmental degradation. Findings include a relation between employment diversification and environmental degradation and exacerbating effects of policy that disfavors rural farmers in terms of development and economic exchange. Section 3, “Changing Rights to Land and Other Resources,” discusses the disruption to land-use patterns and rights brought about by rapid social and economic change and explores implications for natural resource abuse. Finally, section 4, “Local Management Strategies,” explores the diversity of local management systems and the conflicts in land-use interests among social classes, between local and national interests, and between local and extra-local management institutions.

Keywords: Social structure, social processes, historical factors, social and cultural impacts, environmental degradation, agricultural development.

34. Machlis, G.E.; Force, J.E.; Burch, W.R. 1999. The human ecosystem as an organizing concept in ecosystem management. In: Szaro, R.C.; Johnson, N.C.; Sexton, W.T.; Malk, A.J., eds. *Ecological stewardship: a common reference for ecosystem management*. Oxford, UK: Elsevier Science: 21-36. Vol. 2.

This chapter is from a volume on ecological stewardship intended as a practical reference for scientists and resource managers on the subject of ecosystem management. The chapter is prompted by the observation that increasing social inequality and the unequal distribution of the world's resources magnify challenges and add new challenges to the management of ecosystems. As the population of the human species continues to grow and force pressure on the world's biophysical resources,

resource managers are increasingly seeking models that are able to reflect greater human demands coupled with decreasing natural resource productivity. The authors aim to elucidate the contributions that a human ecological perspective of ecosystem management may offer ecosystem managers, present human ecosystems as an organizing concept for ecosystem management, and develop an integrated theory of ecology that interrelates the ecologies of all life forms. The human ecosystem is described and presented in a working model as the interactions between critical resources and the human social system. This summary definition provided is “a coherent system of biophysical and social factors capable of adaptation and sustainability over time” (p. 24). Key components of the model—natural resources, socio-economic resources, cultural resources, social institutions, social cycles, and social order—are defined and discussed with attention to ways in which they can be measured and how they may influence other components within the model. Potential applications of the human ecosystem model are proposed: (1) work as an organizing framework for social impact assessments (SIAs), (2) be a guide for the development of social indicators, (3) serve as a basis for monitoring the activities of natural resource agencies, (4) introduce the human ecological sciences into management training, and (5) incorporate social science inquiry into issues related to ecosystem management. It is suggested that this model operate as a beginning point and be revised as it is tested and applied.

Keywords: Human ecology, human ecosystem, social institutions, ecosystem management, conceptual framework, natural resources.

35. McCay, B.; Jentoft, S. 1998. Market or community failure? Critical perspectives on common property research. *Human Organization*. 57(1): 21-29.

McCay and Jentoft review perspectives on communal resources and place emphasis on the role of community in resource extraction practices, institutional arrangements, and motivations for resource use and conservation. The authors suggest that a more thorough understanding of the human-environmental relation is needed. Specifically, an understanding that is grounded in its particular spatial and historical circumstances. Ethnographic work is suggested as a means to studying specific common property systems because it would better accommodate a focus on the causes and consequences of resource overuse rather than having to rely on abstract models of common property use, which, the authors argue, are often overly simplistic and misleading. Whereas resource use of the commons is embedded in the social context of that particular community, “community failure” as opposed to market failure may better describe some circumstances that have resulted in the misuse and abuse of common resources. Research needs are identified and include determining what extent state intervention de-legitimizes the role of established social norms in the regulation of resource use and the social ramifications of the introduction of market systems.

Keywords: Common property, resource management, environmental policy, embeddedness, social capacity.

- 36. Michalos, A.C. 1997.** Combining social, economic, and environmental indicators to measure sustainable human well-being. *Social Indicators Research*. 40: 221-258.

This article is a revision of a paper presented at the “Colloquium on Assessing Human Well-Being: A Critical Element of Assessing Progress Toward Sustainable Development” in London, Ontario, in 1995. The premise of its discussion is that if we wish to quantify our quality of life or human well-being, a comprehensive system of indicators that includes not only economic and social indicators but also indicators of environmental degradation and resource conservation is needed. Michalos surveys some of the social, economic, and environmental indicators that are available for the analysis of human well-being and demonstrates some of the challenges to integrating indicators from different disciplines into a single measure of human well-being. His analysis begins with the question “What is it we wish to sustain?” and notes that different objects of sustainability will necessitate the use of different indicators and methods. Three examples of fields (health, fishing, and energy) that have indicators that can illuminate dimensions of social well-being are provided. The energy example is discussed in the most detail with attention to the costs of energy exploitation often not accounted for in traditional cost-benefit analysis. Further analysis of energy-related indicators reveal that some of the political and economic agreements Canada has entered into are, in fact, associated with declines in human well-being. In conclusion, the author suggests that the problem of missed costs that arise from assessments based on an assumed comprehensive model of human well-being can be (at least in part) addressed through “cost-benefit dominance.” In this procedure, a group of social-economic-environmental phenomena that are generally agreed to be positive or negative indicators of well-being are identified and monitored over time. A brief appendix profiling the “paradox of social planning” is included.

Keywords: Social indicators, economic indicators, environmental indicators, human well-being, sustainability, Canada.

- 37. Moran, E.F. 2000.** Human adaptability, an introduction to ecological anthropology. 2nd ed. Boulder, CO: Westview Press. 446 p.

Moran presents a discussion of human adaptation to various ecosystems—arctic, high altitude, arid land, grassland, and tropical rain forest. This discussion included a comprehensive discourse on the development of ecological anthropology, research methods, and practical applications in various ecosystems. The impacts of political economy, global environmental change, demography, and the uses of remote sensing in the study of human ecology also are discussed.

The book is divided into three sections and focuses on the mechanisms of human adaptability while integrating findings from ecology, physiology, geography, and social and cultural anthropology around a set of issues and concerns. The question asked is: How do humans adapt, mitigate, accommodate, and respond to a changing natural environment? Moran argues that the study of human adaptability provides a framework for the integration of social systems and natural systems.

The first part introduces the history, methods, and principal concepts relevant to the study of ecological anthropology. The second part specifically describes studies of human adaptability focusing on mechanisms used by groups in various settings to exploit, and even expand, the resources of their surroundings. The biomes addressed are arctic zones, high altitudes, arid lands, grasslands, and humid tropics. Within each chapter, Moran identifies the constraints and responses within each ecosystem and reviews the state of knowledge concerning how global change impacts these ecosystems.

Part 3 addresses new directions in environmental anthropology. Advancing social science theory as well as the practical understanding of human-environment relations through the use of remote sensing and geographical information systems are discussed. Moran argues that the fragmentation of social sciences and myopic approaches to environmental issues can be strengthened through the integration of human ecology and environmental anthropology. The author calls for the integration of disciplines rather than further fragmentation through single-discipline research. Moran refers to the scientific study of the human species in its environmental context as “sustainability science” and “integrative science”—cutting across the biological, physical, and social sciences.

Keywords: Human ecology, ecological anthropology, integration, ecological analysis.

38. Mosse, D. 1997. The symbolic making of a common property resource: history, ecology and locality in a tank-irrigated landscape in south India. *Development and Change*. 28(3): 467-504.

In the discourse concerning the management of common property natural resources, much attention has been given to the idea that reinstating or reproducing existing indigenous management systems is an effective means for the rational and equitable regulation of natural resources. This article explores the social and symbolic role of indigenous tank irrigation systems in Tamil Nadu, south India, and discusses deficiencies of the economic-institutional and moral economy models of common property systems in representing indigenous water resource management. Mosse argues that narrow views of resource management and value on behalf of policy science and classic economics, remove common resource management from its social and historical context and fail to take into account that management of common resources is based on social institutions generated in specific ecological contexts. To begin, Mosse discusses the relation between environmental factors and social management of natural resources. Whereas social institutions help shape the ecology of an area, social structure and institution will also embody ecological and geographical dimensions. A review of the historical development of the Tamil tank irrigation systems is presented with emphasis on its evolving nature. Mosse argues that, contrary to popular belief, present levels of resource degradation are not a result of state intervention but rather can be traced to the development of an isolated village tradition that undermined any overarching political structure. He maintains that the tank irrigation system is a social institution through which social hierarchy is expressed and recreated sometimes to the point where efficiency of resource use and agricultural production are sacrificed for management decisions that favor social harmony and buttress existing systems of social dominance. Variations in water resource control are examined in diverse physical environmental conditions to

illuminate the relation between social institution and ecological constraints. Findings are discussed in terms of their implications for the establishment of new formal community management systems. Mosse suggests that to determine what form an effective new management system will take, development personnel will need to go beyond an analysis of tradition, take heed of the dynamic nature of social and symbolic meaning of common resource use, and seek to strengthen subordinates' access to and control over resources.

Keywords: Common property, water resources, resource management, human ecology, social meaning, social identity, symbolic meaning, south India.

39. Myers, N. 1993. The question of linkages in environment and development. *BioScience*. 43(5): 302-310.

In contrast to institutionalized approaches to the environment and development questions based on management sectors and disciplinary lines, this article examines the nature of links that connect all relations into a never-ending web. The article focuses primarily on the links between the environment and development but aims to direct us toward more link-based thinking in all realms of human activity. A conceptual framework of the nature of links is presented and illustrated through a discussion of links associated with oceans. Myers argues that management bodies are maladapted to manage linked phenomena because they are designed to address single-sector issues and therefore have narrow, institutionally defined understandings of problems. These institutional limitations are exemplified in a presentation of seemingly contradictory actions of different sections of the same government. Four types of links are discussed and illustrated by examples found in development and the environment:

1. Linked links are described as phenomena in which one link triggers another, resulting in an amplified effect that has more drastic consequences than the original effect. Therefore a linked linkage often has unanticipated, far-reaching impacts.
2. Synergized links are two links that work together for an amplified, multiplicative rather than compounded, impact. Relations between population growth and environment dynamics often have synergized characteristics.
3. Relations between the present and the future are termed present/future links. Present/future links often have unanticipated consequences for future generations.
4. Superscope links are links with far-reaching effects, typically at a global scale and affecting current as well as future generations.

Myers discusses the constraints to change found in current political processes and suggests that policy interventions would be the best arena in which to begin to institutionalize more systems-based thinking and approaches to management. A natural-resource accounting system, which better assesses the state of economies and remedies the current oversights of natural capital depletions, is recommended. In addition, a parallel policy that allows for pricing adjustments to reflect the true costs of production, such as a full social cost pricing system, also is proposed.

Keywords: Development, environment, economics, links, resource-accounting, institutional constraints, systems.

40. Norton, B.G. 1991. Ecological health and sustainable resource management. In: Costanza, R., ed. Ecological economics: the science and management of sustainability. New York: Columbia University Press: 102-117.

Norton addresses the lack of a specific, common framework for understanding ecosystem health and suggests that a mathematically precise definition of ecosystem health applicable to all circumstances is simply not possible. The application of medical analogies to ecosystems is discussed including the metaphorical role of “doctor” assigned to ecologists and land managers. Norton explores the benefits and lessons implied in medical analogies and notes that the usefulness of the medical analogy breaks down at the question of scales. Ecologists and land managers do not enjoy the same concreteness as doctors in terms of the objects of their work, the appropriate scale of the object (the unit of a body has no ecological equivalent), and consensus in social values. The lack of scale, that is, no definition of what constitutes a whole ecosystem, is the greatest limit to the medical analogy’s capacity to structure a definition of ecosystem health.

Norton outlines four meanings of wholeness that have been applied to ecosystems and draws lessons from each to determine a more realistic approach to ecosystem analysis. He finds that in terms of public policy, metaphysical conceptions of ecosystems (for example, “the universe is one”) confuse matters rather than illuminate valid approaches. Although contextual conceptions (for example, “everything is embedded into a larger system”) similarly present paradoxes of scale and perspective, Norton argues that they provide a framework in which these paradoxes can be understood and discussed—ultimately leaving the question of which unit or system of units should be the object of management. The sense of boundary is related to the dividing out of political and ecological systems from the whole. In the case of ecosystem management, the boundaries of an appropriate managerial unit are dependent on the specific ecosystem management objectives. Finally, Norton terms Leopold’s view of an ecosystem (all components involved in the food chain pyramid) a pyramidal conception and characterizes it as “the ideal to save as much as possible the multileveled complexity of dynamic systems.” This vision of an ecosystem emphasizes diversity so that an ecosystem may thrive across time, and consequently, results in a patchier landscape.

Norton concludes that the model for ecosystem health and management (1) will include many systems of different scales that can be used to illuminate any given management situation and (2) should be chosen based on the scale appropriate for the management goals of particular situations (p. 115). Finally the reader is reminded of the roles cultural values and social systems (economies) play in the political dimensions of a managerial unit and that management goals should be developed locally and embedded in the context of larger communities.

Keywords: Ecosystem health, ecosystem management, conceptual approaches, sustainability, scale, systems, management goals.

- 41. Painter, M.; Durham, W.H. 1995.** The social causes of environmental destruction in Latin America. Ann Arbor, MI: The University of Michigan Press. 274 p.

This book is one volume in the series titled "Linking Levels of Analysis" that focuses on the links among systems of different scales. The primary focus of the book is to examine the social processes within Central and South America that have contributed to deforestation and the role of culture in the causes of, and responses to, environmental degradation. As opposed to examining the local relations between people and natural resources, this book focuses on the extra-local political dimensions of ecology and broad-scale cultural institutions by using a political ecology approach. In addition, much attention is directed at the discipline of anthropology and its past, present, and potential relations to ecological inquiry. Unifying themes of the volume include, but are not limited to, three themes. First, customary IPAT (Impact= Population \times Affluence \times Technology) analysis of environmental degradation is inadequate to increase our understanding of the social processes that lead to environmental degradation. Second, environmental degradation by small-holding farmers is the result of poverty and the increasing scarcity of land. Third, political arrangements and institutions lead to capital accumulation that allows for a vast minority to generate significant revenue in the short term, and those profits allow for reinvestment and the expansion of extractive activities in the frontier. Both the second and third points exacerbate the pressure toward environmental degradation in the other. Bibliographic references and an index are included.

Keywords: Scale, links, deforestation, cultural institutions, environmental regulations, political ecology, Central America, South America.

- 42. Parkins, J. 1999.** Enhancing social indicators research in a forest-dependent community. *The Forestry Chronicle*. 75(5): 771-780.

Parkins evaluates social indicators used to measure community well-being. Measuring community well-being has evolved from measuring a single indicator of community stability (timber supply) to a diverse approach by using multiple indicators of community well-being. The author describes the evolution of social indicators research including (1) demography—the science that focuses on the structure, size, and development of human populations; (2) work of the World Commission on Environment and Development, which stimulated and challenged the research community to develop more objective measures of sustainability, in particular, measures that link economic, environmental, and social conditions; (3) the role of social indicators research in the theoretical underpinnings of ecosystem-based forest management; and (4) the growing interest from municipalities in measuring large-scale resource developments on social and economic conditions. The author reviews common social indicators citing examples in rural Canada. Finally, using Peace River, Alberta, as a case study, the author provides an example of multiple research methods.

Keywords: Social indicators, migration, community well-being, employment, case study, Peace River, Alberta.

43. Power, T.M. 1996. Environmental protection and economic well-being: the economic pursuit of quality. 2nd ed. Armonk, NY: M.E. Sharpe, Inc. 251 p.

Power looks at the roles that environmental quality and protected natural landscapes play in the economic well-being of local communities. He discusses the disparities between what is commonly considered economics, which he terms “folk economics,” and the true meaning of economics. He proposes that economics is the study of the way in which societies produce, consume, and exchange goods and services in order to pursue their diverse goals. This must include the noncommercial goods, services, or benefits that contribute to the well-being of an individual but are not commercially accounted for in the market system. To simplify, he suggests that economics is the provision or protection of qualities that are ultimately based on subjective judgments and personal preferences. In contrast, the customary or folk understanding of economics is limited to commercial business activity that does not include noncommercial or nonbusiness aspects of people’s lives. He argues that it is this narrow view of economics that overlooks the contributions the social, natural, and public environment make to the economic well-being of an area. This oversight, he suggests, in combination with the business community’s monopoly on the power and mystique associated with economics has led to a false understanding of economic challenges and, consequently, ill-informed public policy directed at remedying economic problems.

Chapter 1 outlines the book’s primary premises and introduces Power’s conceptual theme—the economics of quality. Chapters 2 and 3 further develop the concept of “economics of quality” and provide many illustrations of the dominance of subjective values—rather than rationality—in economic activity. Chapters 4 and 5 address the economic pursuit of quality in a noncommercial setting. Chapter 4 approaches the noncommercial pursuit of environmental quality and questions why the pursuits of some qualities are seen as economic and why the pursuit of environmental quality is not. Power also addresses some of the tools used by economists to measure the economic value of environmental quality. Chapter 5 addresses the question of whether or not the monetary valuation of some noncommercial qualities is wise. Chapter 6 examines empirical evidence of the economic importance of environmental quality including visual quality, beautiful vistas, clean air, and reduced crime. Chapters 7 through 10 are directed at the common local, resource-based economy model. Chapter 7 addresses the common economic-resource base model and examines the vision it provides. Power argues that its shortcomings are related to its limited view of the local economy that does not account for the nonmarket benefits of the local environment. Chapters 8 and 9 examine the limits to common public policy strategies to increase economic well-being. Chapter 10 outlines an economic development plan that accounts for noncommercial and qualitative goals. The final chapter, chapter 11, discusses some of the ways the traditional capitalist economic system disallows progress toward economic well-being. Further public policy approaches are recommended to improve the current situation. References and an index are included.

Keywords: Economic well-being, environmental protection, noncommercial values, environmental values, nonmarket values.

- 44. Rappaport, R.A. 1984.** Pigs for the ancestors: ritual in the ecology of a New Guinea people. 2nd ed. New Haven, CT: Yale University Press. 501 p.

This book addresses the role of ritual in the relation between humans and the environment. Rappaport argues that ritual does, in fact, have material effect in the ecology of the Tsembaga people and that ritual operates as a mechanism that maintains ecosystem variables at viable levels. The study is based on fieldwork done in New Guinea among the Tsembaga people between October 1962 and December 1963. Chapter 1 outlines some of the conceptual basis for the study and discusses the relation between ritual and the environment. Chapter 2 provides an introduction to the Tsembaga people including their location and linguistic relationships among populations, their demographic and physical characteristics, the system of population dispersion and social organization, and the tribal political structure. In chapter 3, the nonhuman aspects of the Tsembaga ecology are described and the subsistence activities of the Tsembaga are discussed. Chapter 4 addresses the Tsembaga relationships to other local populations. In chapter 5, Rappaport discusses the ritual cycle and the conditions that prompt progression through the ritual cycle and presents the functionality of rituals in terms of maintaining the human and pig populations within the ecological carrying capacity. He suggests that the function of ritual in the ecology of the Tsembaga population is to prevent degradation of the environment, limit intertribal fighting, adjust man-land ratios, facilitate trade, facilitate the distribution of meat, and allow for a reserve of protein in case of stress. In chapter 6, Rappaport discusses in greater detail the role of ritual in the regulation of ecological systems. The 1984 edition also includes an extensive epilogue in which Rappaport addresses some of the nonethnographically particular criticisms generated from the first edition. Appendices and an index are included.

Keywords: Human ecology, ritual functionalism, ritual, New Guinea.

- 45. Rapport, D.; Costanza, R.; Epstein, P.R. [et al.]. 1998.** Ecosystem health. Malden, MA: Blackwell Science. 372 p.

The authors introduce the principles and practices of the emerging field of “ecosystem health” and showcase some examples of analyses of ecosystem health. Ecosystem health is defined as “an integrative field exploring the interrelations between human activity, social organization, natural systems, and human health” with a focus on “the human condition at all levels” (p. xii [preface]). Here, ecosystem health is proposed as a holistic, multidisciplinary approach for environmental management that is aimed at enhancing the condition of regional environments toward societal values. The primary human-environment relation analyzed is the relation between the biophysical health of the ecosystem and the clinical health of individuals. Some attention is given to the social aspects of the human-ecosystem interface, namely the role of social values in determining what is considered a “healthy” ecosystem and the role of a healthy ecosystem in the human economy. The chapter that most directly addresses the relation between social well-being and ecosystem health, “The Ecosocial Dynamics of Rural Systems” (chapter 6 by Barkin and Levins) is listed separately in this bibliography.

This book is organized into four parts. Shortcomings in current conceptual and methodological approaches to remedying increasing environmental degradation are discussed in part 1. Ecosystem health is introduced as an organizing concept to

help overcome management difficulties that result from a lack of disciplinary integration. The final two chapters of part 1 discuss the role of metaphor in bridging communication gaps between scientists and nonscientists, emphasize the multidisciplinary character of ecosystem health approaches, and respond to criticisms against the ecosystem health concept. Part 2 deals primarily with ecosystem assessment including participants, their roles, and the ecosystem aspects analyzed. Issues of potential social conflict, inconsistencies across spatial scales, and the roles of cumulative effects in ecosystem health assessment are highlighted. A chapter examining the experiences of community volunteers in watershed health assessments also is included. Part 3 discusses the relations between ecosystem health and sustainability including the importance of decisionmaking and aspects of desirable decisionmaking processes. In addition, criteria for ecosystem health and methods to quantify them are put forward. In part 4, six case studies in which an ecosystem health approach was used are profiled: Chesapeake Bay watershed; Adirondack Park lakes, New York; desert grasslands of the North American Southwest; a comparison of two forested ecosystems in Cuba; environmental change and human health in Honduras; and the Kyronjoki estuary, Finland.

Keywords: Ecosystem health, human health, ecosystem management, multidisciplinary, environmental health, assessments, sustainability, case studies.

46. Rolston, J.; Coufal, J. 1991. A forest ethic and multivalue forest management. *Journal of Forestry*. 89(4): 35-40.

This article is concerned with the development of a true forest ethic in the vein of what Leopold called a land ethic. The objectives of the Society of American Foresters (SAF) listed in the SAF Code of Ethics are analyzed and criticized for an apparently limited, human-oriented perspective of forestry, and one that does not fully reflect the professional role of foresters today. The commodity perspective of forests is discredited because it limits forest values to only those that can be appropriated to benefit humans. In its place, a community perspective is introduced, one that incorporates the intrinsic values of forests and their relation to human communities. The authors map the evolution of a forestry ethic with its beginnings in forest values based on short-term criteria, moving through a longer term "uses" perspective, and finally arriving at the recognition that values of a forest are based on their place in the biotic community rather than as a warehouse of resources for human use. The present SAF code is analyzed and its limits discussed. The authors propose changes to the SAF code that would better encapsulate the change from a use orientation to a biosystem orientation that contains within it a comprehensive community of both human and biotic systems. The authors argue for the need of an ethic based on multiple values as opposed to multiple uses of forests and a movement away from the five statutory multiple uses: recreation, timber, range, watershed, and wildlife and fish. A system of 10 values that better integrate both human and biotic values is proposed: life support values, economic values, scientific values, recreational values, aesthetic values, wildlife values, biotic diversity values, natural history values, spiritual values, and intrinsic values. Each of these proposed values is explained and discussed.

Keywords: Forest ethics, forestry, social values, Society of American Foresters.

- 47. Torras, M.; Boyce, J.K. 1998.** Income, inequality, and pollution: a reassessment of the environmental Kuznets curve. *Ecological Economics*. 25: 147-160.

Research has indicated that air and water quality may be related to per capita income in an inverted U-shaped manner, such that as per capita income rises, air and water quality initially worsen but ultimately improve with income. This phenomenon has been referred to as the “environmental Kuznets curve” because it resembles Simon Kuznets’ (p. 147) findings on the relation between per capita income and income inequality. This article investigates the links between changes in income distribution (income inequality) and environmental degradation. The authors hypothesize that power inequality will be associated with higher levels of pollution because those who benefit from pollution-generating activities are more able to force the costs of those activities onto less powerful social sections. A review of the political economy associated with the environmental Kuznets curve is presented including a brief discussion of income, power, individual preferences, market failure, and civil rights. The dependent, environmental quality variables are three variables on atmospheric pollution (sulfur dioxide, smoke, and heavy airborne particles), two variables on water quality (dissolved oxygen and fecal coliform), and two national-level variables on the percentage of the population with access to safe water and sanitation facilities. The explanatory variables include income, income inequality, literacy, political rights and civil liberties, urbanization, and global environmental monitoring system (GEMS) control variables. Findings on relations between individual variables are discussed and generally support the hypothesis that greater inequality in the distribution of power leads to more pollution. In addition, the authors also find that power inequality variables generally have stronger statistical significance than per capita income as a determinant of environmental quality. A closer investigation of relevant peaks and troughs calculated from the regression results indicated that for countries with already high income levels, further economic improvement can lead to a turn back toward environmental degradation. Policy implications suggested are that in developing countries, increased per capita income and the promotion of greater equity in power distribution may be conducive, even necessary, to improving some important dimensions of environmental quality.

Keywords: Pollution, social inequality, income, power distribution, development, environmental Kuznets curve, political economy, indicators, environmental degradation.

- 48. White, R. 1980.** Land use, environment, and social change: the shaping of Island County, Washington. Seattle, WA: University of Washington Press. 234 p.

Using a social/ecological historical perspective, White takes a critical look at the relation between the environments and the inhabitants of Whidbey and Camano Islands in western Washington. From the first Native American residents to the relatively recent Euro-American occupation, White examines the changes in the environment induced by man, the social and political circumstances that motivated those changes, and the consequences of such changes on the societies that made them. He presents seven chapters, each profiling a separate era of social, technical, and environmental change. He begins with a study of Indian land use and methods of environmental manipulation. Chapter 2 focuses on the introduction of White farmers and frontier culture to the islands and subsequent attempts to shape the land to fit

culturally desirable characteristics. This era ushered in not only the changes consciously initiated by White farmers seeking to "improve" the lands, but with it brought an ecological invasion of both humanly desirable and undesirable species with varying ability to adapt to local conditions. The third chapter examines the farmers' struggle to meet social, political, economic, and ultimately ecological stability, which was thought to be only attainable through the application of "good farming." Chapter 4 profiles the growth of bull-team logging, the amount of waste generated from logging practices, and local dissatisfaction over the limited economic benefit realized from the inefficient logging technique. Chapter 5 explores the social change and environmental consequences associated with the development of new logging technologies. Chapter 6 studies the remaining acute cultural attachment to farming as a lifestyle and the attempt to reclaim lands decimated by logging through an increased emphasis of settlement and farming. The final chapter looks at the impact that tourism and suburban development, as well as the accompanying human preference for some token aspects of the natural world, has had on the ecology of the islands. The human technological and ecological invasion brought by man has significantly altered the operation of natural systems and, in essence, created entirely new, managed systems. The environmental consequences include declines in moisture retention, erosion of soils, changed species composition in forests and prairies and, more recently, limits in the availability of fresh water. In his concluding section, White reminds the reader that historically, both Native and American societies valued the land for its utility and, to the amount their level of technology would allow, manipulated the land to serve their needs. The difference between the experiences of the two is that the American emphasis on refining technology to improve the efficiency of logging, fishing, and farming techniques accelerated the rate at which the environment was being changed and outpaced society's ability to gauge the environmental consequences and develop social institutions to control them.

Keywords: Land use, social values, development, environmental degradation, human impact, agriculture, social change, Island County, Washington.

49. Wickramasinghe, A. 1997. Anthropogenic factors and forest management in Sri Lanka. *Applied Geography*. 17(2): 87-110.

In many places, including Sri Lanka, states have assumed management responsibilities for natural areas with the intention of managing the resources efficiently and protecting them from overuse and exploitation, often without considering the local population's reliance on such resources. This paper explores the indigenous use of forest resources from a natural reserve in Sri Lanka with an aim to determine which factors of traditional forest management have made enforcement of the natural reserve difficult. Data were collected from September 1994 through April 1995 on traditional forest use in the villages surrounding Ritigala. The relevant factors discussed are (1) forest resource utilization, (2) the relative location of the village, (3) forest-resource-based income, (4) indigenous knowledge of forest resources, (5) gender and resource decisions, (6) community rights and social regulation, (7) rituals and perceptions, and (8) legal authority and customary rights. The data indicate that although some cultural fragmentation has occurred, group engagement of the village communities in forest management is strong. The author suggests that exclusion of local participation in the design and use of the natural reserve would prove the natural reserve ineffective. The findings suggest that if community rights

are mutually accepted and enforced, they can form the basis for sustainable forest management. As survival of the communities that surround the forest are dependent on those resources, and local understanding of human involvement in the forest is necessary for its long-term sustainability, the author maintains that consideration of local uses and knowledge of the forest and the incorporation of local social institutions in planning processes are crucial components to a successful management plan aimed at the conservation of natural areas.

Keywords: Common property resources, local participation, social institutions, forest resources, forest management, nature reserves, planning process, Sri Lanka.

50. Xu, Z.; Bradley, D.P.; Jakes, P.J. 1995. Measuring forest ecosystem sustainability: a resource accounting approach. *Environmental Management*. 19(5): 685-692.

The authors present a framework for a resource accounting system that is designed to assist natural resource personnel with managing forest ecosystems in a way that allows for current generations to enjoy product and service flows from forests without limiting the production capacity of ecosystems for future generations. Once fully developed, the resource accounting system would serve as a tool for organizing and presenting information. The framework uses the concept of natural capital, which suggests that forest ecosystems function with a dual role as productive ecosystems and as sources of raw materials for economic activity. Limitations of current accounting systems and the possible benefits of a forest resource accounting system are discussed. The authors suggest that forest resources must be approached as having two roles—actual capital that is available to current generations and potential capital that forest resources can provide future generations. To ensure a forest's ability to provide capital to future generations, current generations must preserve the potentials of ecosystems and maintain or improve the integrity of productive capacity. Forest resource accounts that link ecosystem function with actual and potential income-producing capacity of the forest would assist managers in designing and assessing management regimes that are sustainable. In addition, forest resource accounting would allow managers to monitor the integrity of forest ecosystems in order to understand the true productive capacity of forest systems. Three components of a forest resource accounting framework are suggested and presented in a conceptual framework: (1) a set of monetary and physical accounts that reflects current use of resources and systems; (2) a set of indicators to reflect potential value including qualitative and quantitative indicators of ecological accounts; and (3) a set of link accounts designed to tie together the actual and potential capacity accounts that focus on the costs and potentials of resource use. The identification of indicators and proxies for ecological or potential capital is one of several topics of research needed to advance the integrated accounting system beyond the early stages of development.

Keywords: Resource accounting, forest management, sustainability, ecosystem management, future value, ecosystem integrity, indicators.

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