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Natural Resources, Environment and Development in Ecological Perspective

A Sourcebook for Teaching and Research

edited by
Michael Micklin
Natural Resources, Environment and Development in Ecological Perspective

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A Sourcebook for Teaching and Research

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The notion of sustainable development is at the same time one of the most overworked cliches in contemporary social science and an idea of crucial import to the future of human society. While it would be pointless to count the number of references to this concept over the past two decades, it is safe to say they are legion. Scores of books and articles have been devoted to the meaning of sustainability, the indicators in terms of which it can (or can't!) be measured, the barriers that prevent its attainment, and the strategies through which it might be realized. My reading of this literature, which grows with each passing month, leads me to several conclusions. First, debates over the conceptual, theoretical, methodological, and strategic issues of sustainability have one common denominator: the irrefutable symbiosis between collective human welfare and conditions and trends in the nonhuman environment. Second, the most pressing scientific and practical puzzles surrounding the accomplishment of a sustainable course of societal development are to be found in low-income countries. This is not to say that issues of sustainability are unimportant for the world's richer nations; rather, I contend simply that the challenges to scientific understanding and effective intervention are greatest with regard to the Third World. Finally, I conclude that current answers to questions about the causes and consequences of unsustainable development trends are unsatisfactory. Scientists and policymakers alike must rededicate themselves to the tasks of making better sense out of what we know and extending our knowledge so as to reduce ignorance of critical sustainability issues. This collection of materials linking development and the environment is intended to provide a convenient base for pursuing these objectives.

This Sourcebook began as a reading list for a graduate seminar I developed for the Department of Urban and Regional Planning at Florida State University in
1988. It reflects my efforts over more than two decades to forge a viable link between conceptual and theoretical approaches developed in the various social science disciplines and emerging practical concerns over the use and abuse of the physical environment. While the principal purpose of this work was originally to provide supplementary reading references for my students, particularly in connection with the preparation of term papers, theses, and dissertations, I have also distributed earlier versions of the bibliography to a number of colleagues and have been pleasantly surprised by their positive reactions.

Although the bibliographic citations are concentrated on materials pertaining to the developing countries, this work necessarily includes some items reflecting a global perspective and others, relatively limited in number, that deal with environmental issues in the more developed nations. In fact, of course, the environmental problems of less and more developed countries are inextricably intertwined, an elementary observation that is nonetheless fundamental to the ecosystem perspective. While no attempt is made to categorize materials by country or geopolitical region, most of the developing world is represented in one section or another.

The materials covered in this Sourcebook span a wide range of disciplines. In accord with the underlying theme of societal development, emphasis has been placed on the social sciences, most obviously anthropology, economics, geography, political science, and sociology. However, the references cited go far beyond the traditional boundaries of these disciplines because of my strong belief that the conceptual framework most suited for addressing the complexities of societal development in the modern world is that of human ecology, an inherently synthetic perspective.

Since 1972, and the first United Nations Conference on the Environment, the literature on environment and development has grown enormously. It is now so large that any bibliographic summary must be selective. The materials included here were available (or forthcoming) as of mid-1995. I have concentrated on publications that have appeared over the past decade or two, although citations to particularly useful earlier work are also included. The bibliography is selective in two additional respects. I have included only materials published in English, but this decision in no way suggests that they are necessarily of any greater importance than items written in other languages. I have also chosen to omit unpublished works that might not be readily available to the reader.

The Sourcebook is divided into four chapters, which are further divided into four sections. Each chapter contains a brief introduction that provides an overview of the types of materials referenced in the four sections as well as the intellectual issues they reflect. The reader should note that the works cited in the introductions are only illustrative of the principal topics and perspectives covered in the bibliographies that follow. A much larger number of citations is provided for
nearly every topic mentioned, and other references that are less directly relevant are also provided.

Chapter I, Ecology and Development, covers conceptual, theoretical, and methodological issues. It is premised on the assumptions that any consideration of relationships between environment and development must begin with the ecosystem perspective and that the eclectic field of human ecology provides a useful theoretical basis for understanding human-environment interactions. This chapter also includes sections focused specifically on ecological dimensions of the development process and on problems of environmental measurement and monitoring.

In Chapter II, Natural Resources and the Development Process, attention turns to the significance of selected natural resources for societal conditions and trends. The first section includes social science contributions to natural resource theory, and is followed by one devoted to assessments of global and regional resource stocks and flows. The remaining sections cover two categories of natural resources: non-fuel minerals and energy, and land, water, forests and biodiversity.

Chapter III, Environmental Impacts of Third World Development, is focused on environmental quality, or what some observers refer to as the "life support system" and "sink" functions of the environment. The first section includes general discussions of relations between environmental quality and development. The other sections are devoted to three specific dimensions of the human habitat: atmosphere and climate, land degradation and desertification, and the physical dimensions of human settlements, particularly cities.

Chapter IV, Planning and Organizing for Sustainable Development," examines the delicate problem of balancing the need for continued consumption of natural resources in the interest of improved human living standards with that of environmental preservation and conservation. Materials cited reflect the planning as well as the implementation phases of integrating environmental and development objectives. The first section covers major obstacles to and strategies and opportunities for accomplishing this task. The following two sections are focused on strategies and policies designed specifically for natural resource management and life support system protection, respectively. The final section includes works from the emerging field of environmental ethics.

Decisions about the chapter and section location of some references proved difficult, as I have not been able to review all of the materials included. Moreover, the most appropriate location of even those I was able to read was not always obvious. For example, some of the works cited provide both theoretical guidance and strategies for achieving sustainable development. Others encompass two or more of the different substantive areas into which the materials are organized. Thus some of the citations appear under two or more headings, and others could easily have been listed more frequently than they are. In the interest of parsimony
I have tried to minimize these duplicate citations. Users should be aware that the classification system adopted is necessarily imperfect.

Individuals associated with two institutions have been particularly helpful in bringing this project to fruition. During each of the past three winters I have spent approximately one month using materials located in the library at the University of Hong Kong. My work during the winters of 1993 and 1994 was made possible through an appointment as Visiting Fellow at the UHK’s Centre of Urban Planning and Environmental Management, while during the winter of 1995 I was appointed as an Honorary Professor in the Department of Sociology. My thanks to Bill Barron and David Levin, respectively, for facilitating these affiliations. As I was preparing the final version of the bibliography I was faced with the inevitable problem that some references were incomplete. To the rescue came Peter Proman, director of the Johns Hopkins School of Advanced International Studies (SAIS) library. He and his assistant, Jim Fitch, provided an assortment of publication details with an alacrity for which I am most grateful. Finally, Dr. Anthony G.O. Yeh of the Centre of Urban Planning and Environmental Management facilitated arrangements for publication. Without his encouragement and cooperation this work might still be “in progress.”
I. Ecology and Development

The collection of materials cited in this chapter is intended to provide a broad overview of the conceptual, theoretical, substantive, and methodological linkages between the ecological perspective and the study of societal development. During the past couple of decades it has become increasingly evident that the major changes observed in the organization of human societies are the result of complex interactions among three interdependent systems: population, environment, and social organization. While there is no question that it is analytically fruitful to examine each of these systems as if they were independent entities — as seen, for example, in the disciplines of demography, bioecology, anthropology, sociology, geography, and economics — understanding and explanation of the processes and outcomes of societal development requires a more comprehensive perspective. The kind of holistic outlook called for is found in the often ignored and sometimes misunderstood hybrid field of human ecology.

Section A of this chapter contains a limited set of references that outline the ecosystem perspective, in whole or in part. Of particular import for the nonspecialist are several book-length overviews and histories of the field of bioecology (e.g., Odum 1971; McIntosh 1985; Worster 1985; Bramwell 1989; Allen and Hoekstra 1992). In addition, however, I have included some classic discussions of modifications and elaborations of the ecosystem perspective that emerge when the role of the human species is given explicit attention (Duncan 1959, 1964; Hawley 1968; Boulding 1978; Moran 1984), as well as some alternative macroecological frameworks (e.g., Brown 1995). Finally, the critical influence of environmental conditions and processes on societal development is covered in recent publications devoted to the topic of global change (Clark 1989; Turner II, Clark, et al. 1990; Stern et al. 1992; McBean 1994). The remaining items cover specific aspects of the ecosystem perspective such as the idea of
carrying capacity, application of the principles of thermodynamics, and conceptualization of ecosystem processes.

In Section B the focus turns specifically to theoretical discussions of the human ecosystem. The number of references cited is necessarily large, as practitioners of a wide variety of social science disciplines have developed approaches based in one way or another on the ecological perspective. I have purposely chosen to provide relatively inclusive coverage for several reasons. First, representations of ecological thinking in the various social science disciplines differ markedly, and I believe it is useful to make available the widest possible range of ideas. Second, many of these approaches have yet to be applied to substantive issues related specifically to societal development when, if fact, they may offer new insights. For example, the approach typically labeled organizational ecology (Hannan and Freeman 1977, 1989a; Carroll 1984), which addresses questions of competition and survival among formal organizations, could usefully be transferred to studies of the development process. Third, among the many varieties of human ecological theory none has proven to be superior in terms of generally accepted criteria for theoretical evaluation, e.g., parsimony, logical consistency or, most tellingly, predictive power. Future advances in the application of this perspective will require closer critical examination of alternative formulations. Finally, linkages between theoretical frameworks in human ecology and the resolution of practical problems of Third World development are still being forged. In short, I believe that there is much work ahead in terms of assessing the strengths and weaknesses of contending approaches to human ecological theory with specific reference to societal development. The wide range of theoretical ideas cited here is therefore intended to stimulate the ecological imagination.

Perhaps because social science applications of the ecological perspective were first evident within the field of sociology (Micklin 1984), the widest variety of disciplinary theories is found there. The most prominent and influential version is seen in theories of the internal organization of human societies (Hawley 1950, 1986; Duncan and Schnore 1959; Poston et al., 1984; Schnaiberg and Gould 1994). More recently, however, sociologists have renewed their concern with the process of societal evolution and how it is influenced by environmental constraints and opportunities (Lenski 1970; Catton 1980; Nolan 1984; Sanderson 1990; Lenski et al. 1991). Another group of sociologists (e.g., Catton and Dunlap 1978; Dunlap and Catton 1979b; Buttel 1987) has been more concerned with identification of broad societal orientations toward the environment and how they are reflected in collective efforts to deal with environmental problems.

Theories about society-environment connections have proliferated in other social sciences as well. The field of environmental economics has grown rapidly

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1 The seeds of such an approach are seen in Hannan et al., 1995.
(Pearce and Warford 1993; Tisdell 1993). Particularly evident in recent years are views that are critical of neoclassical, market-oriented treatments of natural resource and pollution abatement issues (Martinez-Alier 1987; Costanza 1991; Berger 1994; Daly and Cobb 1994). Political scientists and policy analysts, sometimes adopting the banners of ecopolitics or green political theory, have concerned themselves with the influence of environmental issues on government decision-making and party politics on the national level, as well as their role in international disputes and agreements (Dryzek 1987; Dobson 1990; Atkinson 1992; Choui 1993; Swift 1993; Gurvov 1994). While the environment is by definition central to the field of geography, new theoretical issues and orientations have arisen there as well (Hill and Hanson 1984; Smil 1994; Zimmerer 1994). And finally, some anthropologists continue to pursue the reciprocal relationship between culture and environment (Bennett 1976; Harris 1979; Jones 1987; Butzer 1990).

During the past few decades the study of Third World development has reflected increasing concern with environmental conditions and processes. On the one hand, maintenance of a continuous supply of natural resources and preservation of the environmental life support system are essential for socioeconomic development, however this ambiguous notion is defined. On the other hand, as societal development proceeds there can be little doubt that various dimensions of the natural environment are affected, sometimes for the better and sometimes for the worse. A voluminous literature has emerged from efforts to document, challenge, and otherwise elaborate these basic propositions, and is covered in Section C of this chapter.

There are numerous angles from which the relationship between environment and development can be approached. Many of the fundamental issues are captured in the ongoing debate over the concept of and barriers to sustainable development (Redclift 1987; Dixon and Fallon 1989; Pezzey 1992; Jacob 1994; Munasinghe and Shearer 1995b). To be sustainable, it is argued, socioeconomic transformations cannot destroy or damage irrevocably the physical systems on which they depend. Debate centers around the extent, causes, and remedies for the environmental havoc believed to result from local, national, regional, and global efforts to increase economic output and improve living standards.

Another hotly contested issue concerns the connections between population change --- particularly growth --- and the other major components of the global ecosystem, i.e., the physical environment and human social systems. The arguments presented range from those that portray the world as already suffering from serious over-population (Keyfitz 1991b, 1993; Brown et al., 1992) to those that find no justification for limiting population growth in the interest of ecological stability and/or improved opportunities for socioeconomic development (Simon 1981, 1986; Eberstadt 1995). Between these extremes one finds assessments that, while recognizing the necessity of the ultimate cessation of population growth, at
the same time avoid unqualified claims about causal connections between it and various environmental and development problems (Kelley 1988; Teitelbaum 1992/93; Merrick 1994; Preston 1994).

Another ecological issue of development that has emerged over the past decade concerns the implications of environmental change for national and global security (e.g., Mathews 1989; Gleick 1993; Myers 1993c). The most common argument in this vein is that deteriorating environmental conditions pose a major threat to political and economic stability as well as prospects for alleviating Third World poverty. An extension of this argument suggests that conflict over scarce environmental resources may well lead to violent confrontations between competing groups and/or nations (Diaz-Briquets 1986; Homer-Dixon 1991, 1994a; Choucri and North 1993b).

A final illustration of a key issue emanating from the reciprocal relationship between environment and development is seen in the controversy over the ecological impacts of international trade (Lutz 1992a; Berlin and Lang 1993; French 1993; Muñoz and Rosenberg 1993; Zaelke et al. 1993; Daly and Goodland 1994b, 1994c). Historically, most economists have viewed trade as a stimulant to development. Recently, however, attention has been concentrated on the environmental problems generated by international trade, including obvious ills such as resource exhaustion in very poor countries that have no alternative sources of income as well as more elusive issues regarding disincentives to protect environmental quality. Needless to say, arguments for a reduction in the volume of international trade face considerable resistance, regardless of accumulated evidence.

Section C also contains studies devoted to relationships between development and the environment in specific developing nations or geopolitical regions. Noteworthy examples of country studies include work focused on Brazil (Hall 1989; Moran 1993), China (Smil 1993; Edmonds 1994b), Honduras (Stonich 1993), India (Gadgil and Guha 1992), and Indonesia (Hardjono 1991a). Regional surveys are available for Latin America (Goodman and Redclift 1991), the Pacific Rim (Burnett 1992), Southeast Asia (Brookfield and Bryan 1993), and Sub-Saharan Africa (Lewis and Berry 1988; Rosenblum and Williamson 1990). The number of countries for which there is at least one detailed study of environment-development relationships is increasing annually, but systematic regional assessments and comparisons are still scarce.

As concern over the environmental dimensions of global and national development is translated into empirical research, literature concerned with methodological issues has begun to accumulate. Section D of this chapter provides relevant references. The principal topics addressed pertain to compilation of environmental indicators, refinement of measurement techniques, the problem of environmental valuation, and strategies for assessing the environmental impact of development activities.
In spite of continuing efforts to monitor changes in global, regional, and national environmental indicators (e.g., United Nations Environment Programme 1991; World Resources Institute et al. 1990, 1992, 1994), sources of data, particularly for the poorest countries, are limited and of dubious quality. In recent years the use of satellite monitoring technologies has shown considerable promise (McCloskey and Spaulding 1989; Greenland 1994; Running et al. 1994). Still, there is wide disagreement over the environmental impacts of development activities in Third World nations.

Several measurement issues have been emphasized. One that is still not resolved satisfactorily has to do with development of a metric for the concept of sustainability that is acceptable to investigators from differing disciplines (cf. Tisdell 1993; Blamey and Common 1994; Carpenter 1995). Another set of studies has attempted to model ecosystem processes under varying conditions (e.g., Robinson 1991; Maxwell and Costanza 1994; Shuttleworth 1994). Recognizing the significance of how humans perceive environmental conditions and trends, a few investigators have sought to assess environmental orientations of individuals (Lowe and Morrison 1984; Dunlap et al., 1993) and nation-states (Dietz and Kalof 1992), though data for the developing nations are rarely available. Finally, efforts to evaluate the degree of environmental risk are increasing (e.g., Stocking 1989; Hoare 1993; Misch 1994).

Doubtless the methodological issue that has received greatest attention over the past decade is that of environmental valuation, often approached from an accounting perspective. The problem is to assess accurately and comprehensively the real costs of human activities that deplete and degrade environmental conditions and functions. A variety of environmental accounting strategies have been developed (cf. Dasgupta and Maler 1989; El Sarafy 1991; Hannon 1991; Repetto 1992; Lutz 1993; Barbier 1994; Slessor and King 1994), and this approach is now being adopted by the United Nations (1993).
A. The Ecosystem Perspective


Ecosystem Perspective


B. Varieties of Human Ecological Theory


Ecology and Development


International Responses*. Cambridge, MA: The MIT Press.

Perspectives.” Pp. 1-40 in *Global Accord: Environmental Challenges and 

205-253 in *Global Accord: Environmental Challenges and International 

Choucri, N. and R.C. North. 1993. “Global Accord: Imperatives for the Twenty-


Sustainability.” Pp. 75-87 in *Ecological Economics: The Science and 
Management of Sustainability*, ed. R. Costanza. New York: Columbia 
University Press.

Clark, C.W. 1990. *Mathematical Bioeconomics: The Optimal Management of 

Shift.” Pp. 400-415 in *Ecological Economics: The Science and Management of 


Sustainability.” *Ecological Economics* 6 (1): 7-34.


Transition to Sustainability*, eds. R. Goodland, H.E. Daly, and S. El Serafy. 

Ecological Economic Systems: Toward an Evolutionary, Dynamic 


24


C. Ecological Aspects of Third World Development


Ecology and Development


65


Stockdale, J. 1989. “Pro-Growth, Limits to Growth, and a Sustainable
on the Quest for Sustainable Economic Growth. New York: Knopf.
Destruction: A Central American Case Study.” Population and Development
Review 15 (June): 269-296.
of Equity, Environment, and Natural Resource Management.” Development
Consequences of Natural Resource Based Development and Rural
Environment and Development.” Pp. 11-24 in Change: Threat or
Opportunity? Vol. V: Ecological Change: Environment, Development and
Sound and Sustainable Development.” Pp. 49-53 in Expert Group Meeting
on Population, Environment and Sustainable Development. Economic and
Social Commission for Asia and the Pacific/United Nations Development
Nations.
Wildlands, Diversity and Development. London: Earthscan.
Tahvonen, O. and J. Kuuluvainen. 1993. “Economic Growth, Pollution and
Renewable Resources.” Journal of Environmental Economics and
Management 24 (March): 101-118.
University Press.
Taylor, P. and F.H. Buttel. 1992. “How Do We Know We Have Global
Environmental Problems?” Geoforum 23: 405-416.
63-78.


Woodwell, G.M. (ed.) 1990. The Earth in Transition: Patterns and Processes of
Biotic Impoverishment. Cambridge: Cambridge University Press.
World Commission on Environment and Development. 1987. Our Common
World Resources Institute, in collaboration with the United Nations Environment
Programme and the United Nations Development Programme. 1992
Young, M.D. 1994. “Ecologically-Accelerated Trade Liberalisation: A Set of
Disciplines for Environment and Trade Agreements.” Ecological Economics
9 (January): 43-51.
Belgium: Ordina Publications.
Environment Research.” Pp. 9-43 in Environment and Population Change,
Zaelke, D., P. Orbuch, and R.F. Housman (eds.). 1993. Trade and the
and Development. New York: John Wiley and Sons.
Zimmerman, A.H. 1993. “International Trade in Forestry Resources and
Sustainable Development.” pp. 101-107 in Difficult Liaison: Trade and the
Environment in the Americas, eds. H. Muñoz and R. Rosenberg. New
D. Measurement and Monitoring Issues


II. Natural Resources and the Development Process

This chapter features materials that examine and assess the roles played by natural resources in the process of societal development. Early students of social and economic change such as Malthus and Marx gave explicit recognition to the influence of variations in resource availability, quality, and control on national and regional economies and social institutions. However, with the exception of the past two decades, few Twentieth Century scholars have paid much attention to natural resource issues.

The relative lack of attention to connections between natural resources and development is clearly evident when theoretical issues are explored. Available materials are reviewed in Section A, below. Efforts to develop a comprehensive theory of the role of natural resources in human activities have been limited largely to economists (Dasgupta and Heal 1979) or economically-oriented sociologists (Firey 1960). A few authors have addressed conceptual issues such as the question of what constitutes a natural resource (DeGregori 1987; Easterling III 1990; El Serafy 1991). More commonly, efforts have been concentrated on distinguishing the properties and current situation of major resource types, e.g., exhaustible and renewable resources, and their implications for economies of the future.

While it is generally agreed that both historically and currently natural resources have been the principal basis for the creation of wealth (Buttel 1984; Catton et al. 1986; Bernstam 1991), some writers (e.g., Simon 1981b) have argued for the primacy of human ingenuity, claiming that the "ultimate resource" is the human mind. Theoretically, these opposing arguments have quite different implications for the human future. If human ingenuity, expressed primarily through technological progress, can overcome problems of resource availability
(Simon 1981a, 1986), then concerns about the coming scarcity of natural resources (e.g., Allen 1976; Albrecht and Murdock 1986; Barbier 1989) can be put to rest. On the other hand, if widespread natural resource scarcities do emerge, they could become a basis for severe social and economic disruption (Barnett 1980; Booth 1983; Catton 1984) and perhaps even violent conflict within and among nations (Arad and Arad 1979; Midlarsky 1983; Catton 1984b; Westing 1986; Cleveland 1991; Homer-Dixon 1991, 1994; Gedicks 1993). Either way, theoretical discussions of resource scarcity issues can be expected to proliferate.

Factors underlying resource scarcity (or, much less frequently, its absence) have been another important subject of theoretical approaches to natural resources found in the social sciences. Commonly identified causes of scarcity include culturally-based wants, patterns and trends of economic production and consumption, and rapid population growth. Alan Durning (1991, 1992) argues that human societies are mired in an ideology of economic growth and consumption. Allen Schnaiberg (1980; also see Schnaiberg and Gould 1994) refers to the treadmill of production characteristic of highly industrialized societies, emphasizing how institutional factors reinforce the relationship between production and consumption. In a similar vein, William Freudenburg (1992) uses the term addictive economies to reflect the heavy dependence of capitalist economies on natural resources. Whether and how rapidly the treadmill and addiction metaphors will describe accurately the socioeconomic situation of developing nations is an important, but infrequently explored, theoretical issue.

In contrast to the emphasis on the economic bases of resource depletion in more industrialized societies, rapid population growth is more commonly identified as a principal cause of resource depletion in developing nations, though that thesis has been subject to a number of important qualifications (Repetto and Holmes 1984; National Research Council 1986; Slade 1987). Whatever their source, escalating demands on natural resource stocks could ultimately threaten the carrying capacity of local, regional, national and even global environments (Catton 1980, 1993), but the social, cultural, economic, and political dimensions of the idea of carrying capacity are still not well understood.

One big theoretical question that has been examined, largely through statistical modelling, concerns the extent to which the supply and/or quality of natural resources constitute insuperable limits to the growth and development of human societies (Meadows et al. 1972, 1992; Barney et al. 1980; Simon and Kahn 1984). Stated differently, the issue is to determine whether, or under what conditions, exploitation of the earth to serve human needs and purposes would result in irreversible damage to the resource base. In spite of strong opinions expressed by both advocates and opponents of the idea of limits to growth, the question remains unresolved. A principal barrier to doing so is the lack of a compelling and testable theory.

Apart from the broad theoretical issues mentioned above, some social
scientists have been concerned more specifically with implications of the conditions under which natural resources are obtained and used. For example, one area of resource-relevant theoretical work pertains to the consequences of economic dependence on natural resource extraction for communities and regions (Bunker 1984b, 1985, 1989, 1992, 1994; Freudenburg 1992). Generally, extractive industries are believed to create a vicious cycle of dependence which leads to increased environmental degradation and decreasing options for development of less damaging forms of economic activity. Another issue concerns the effects of ownership institutions on resource use and environmental protection. Considerable debate has centered around Garrit Hardin’s (1968) portrayal of the “tragedy of the commons.” The relative merits of private ownership as opposed to common property (or common access) resources have yet to be determined (McCay and Acheson 1987a, 1987b; Berkes 1989; Brox 1990; Feeney et al. 1990; Ostrom 1990).

Section B covers resource stock and flow questions. The central tasks addressed in the literature are, first, to estimate the stock (or supply) of natural resources at varying levels of geopolitical aggregation and, second, to estimate the flow (rate of use and net balance of use/replenishment in the case of renewable resources) of particular kinds of resources. These objectives are pragmatic and important. Nonetheless, available information is typically judged to be inadequate to either test theories of the role of natural resources in societal development or to provide guidelines for interventions needed to protect the resource base. The difficulties stem primarily from methodological problems associated with measurement and monitoring of the resource base (see Section 1.D, above).

In recent years there have been increased efforts to provide a global assessment of the quantity and quality of the resource base (MacKellar and Vining 1987; Cole 1988; World Resources Institute et al. 1990, 1992, 1994). On the whole, these assessments conclude that stocks of exhaustible resources are dwindling, but opinions differ as to whether this should be cause for immediate worry (cf. Norgaard 1990 and Moore 1992, 1995). In contrast, there appears to be growing, though by no means universal, agreement that in many parts of the world demands on renewable resources exceed significantly their rate of replacement.

Evidence regarding regional resource patterns can be derived from some of the global data sources (e.g., World Resources Institute et al. 1992, 1994). Outdated regional or subregional assessments are available for Sub-Saharan Africa (Beyer 1980; Anderson 1984), Asia (Murton 1980; Whitney 1980), Latin America and the Caribbean (Deneven 1980), and the Middle East (Manners 1980). Generally, there is a need for more comprehensive and systematic assessments of global, regional, and national levels and trends of the quantity and quality of natural resources.

Stock and flow resource accounting has also been applied to specific types of natural resources. Studies are available with regard to energy (Edmonds and

Results of these and related studies tend to be inconclusive and often controversial, largely because of the measurement problems already mentioned. Nonetheless, few knowledgeable observers would dispute the conclusion that the demand for natural resources of all varieties continues to increase, and that the rate of growth is now significantly higher among developing nations (Mikesell 1988).

The remaining sections of Chapter II are devoted to two categories of natural resources: non-fuel minerals and energy (Section C) and land, water, forests, and biodiversity (Section D). The materials cited emphasize ways in which the activities and institutions underlying economic and social development are dependent on continued access to natural resources. In addition, some of these studies address problems emerging from situations in which such access is denied, inadequate, or otherwise problematic.

Although Section C covers both non-fuel minerals and energy, the vast majority of the development-related literature it contains is focused on energy issues. While some analysts continue to emphasize that mineral resources still serve as a basic source of national wealth and industrial productivity (Eyre 1978; Tanzer 1980), the availability of substitute materials and more optimistic estimates of mineral deposits have assuaged fears that shortages will soon be a major obstacle to industrial growth (cf. Bennett and Williams 1981), particularly if opportunities for recycling materials are increased (Chandler 1984). Recently attention has turned to the political economy of mineral consumption and trade. A dominant concern is the increasingly precarious position of developing country economies heavily reliant on the export of raw materials (Tanzer 1980; Vogely 1985; Haglund 1986; Barham et al. 1995). In spite of significant decline in the market price of many minerals, these resource-dependent countries and regions have few viable alternatives. Other writers (e.g., Young 1992b) have argued that mineral extraction activities are significant for societal development largely because of the environmental damage they cause and their high energy requirements. The central challenge for many poor countries is to find a more sustainable path to economic survival and social betterment.

In contrast to development scholars’ declining interest in non-fuel minerals issues, concern over problems of energy resources has continued to grow. Following in the footsteps of Fred Cottrell’s classic Energy and Society (1955), several recent studies have explored the multiple symbiotic linkages between human social organization and energy stocks and flows (Rosa et al. 1988; Clark 1990; Smil 1991, 1994; Schipper and Meyers 1992; Stern and Aronson 1994). Energy issues are of particular significance for developing nations. Rapid
population growth (Rasmussen and Zetterstrom 1992; Batiwala and Reddy 1994) and increased economic activity (Edmonds and Reilly 1985; Goldemberg et al. 1987; Soussan 1988; Holdren 1990; Lovins 1991; Holdren and Panchri 1992; Meyers and Schipper 1992; Lenssen 1993; OECD 1994) can only yield greater demand for and consumption of energy resources by Third World countries. Recognition of the severe disruptions in the global economy and energy markets that could result, as well as the real prospect of future energy shortages, has generated efforts to define the role of energy resources and strategies in the quest for sustainable development (Peet 1992; World Energy Council 1993; Flavin and Lenssen 1994; Gleich 1994; Pimentel et al. 1994; Goldemberg 1995). A particular concern is how to meet the rapidly expanding demand for electricity in the developing world (Flavin 1984, 1986; Flavin and Lenssen 1994).

Attention continues to be focused on the changing problems and prospects of specific energy resources. In spite of periodic efforts to promote alternative sources, petroleum remains the primary source of power for human societies and will fulfill that role for the foreseeable future (Al Wattari 1980; L.R. Brown 1984; Singer 1984; Flavin 1985; Auty 1990; Krapels 1993). In most nations other sources such as coal (Beckmann 1984a), natural gas (McDonald 1990; Håmsø et al. 1994), and nuclear fission (Hayes 1976; Flavin 1983) will be supplementary until petroleum is no longer a viable option or until less polluting, renewable sources are technologically and financially feasible (e.g., Hayes 1977a; Flavin 1982; Beckmann 1984a; King and Slessor 1994). A final issue that is still a concern for many developing countries is the dependence of many families on fuelwood for cooking and heating and the corresponding effects on deforestation (Moss and Morgan 1981; Smith 1981; Whitney 1981; de Montalembert and Clement, 1983; Eckholm et al. 1984; O'Keefe and Raskin 1985; Agarwal 1986).

Studies and reviews of the political economy of energy have been reported for most of the major geopolitical regions of the world; e.g., Africa (Raskin and Lazrus 1991; Davidson 1992; Karekezi 1994), Asia and the Pacific (Razavi and Fesharaki 1991; Sathaye and Tyler 1991; Rumani et al. 1992; Sayalath 1995); and Latin America and the Caribbean (Sterner 1991; Munasinghe 1992). Moreover, energy problems and issues have been highlighted for a number of individual countries, especially relatively populous ones such as China (Smil 1976, 1988, 1993; Perluck et al. 1991; Sathaye and Tyler 1991; Levine et al. 1992; Dorian 1994; Jiang Zhenping 1994) and Brazil (Geller and Zylberstajin 1991; Rask 1995).

Not surprisingly, the largest number of studies cited in this chapter pertain to the fundamental natural resources upon which all economies depend: land, water, and forests. They are located in Section D, along with materials focused on the related issue of biodiversity.

During the past decade or so a number of comprehensive assessments of global and regional land resource problems have been published (e.g., Revelle 1984; Blaikie 1987; Blaikie et al. 1987; Little and Horowitz 1987; Richards 1990;
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Jolly and Torry 1993b; Heilig 1994). The issues covered are highly variable, ranging from the influence of topography on the subsistence potential of human populations to ways in which social and cultural institutions affect land use patterns. Because land can be used for a variety of purposes — e.g., to produce fuel or food, and within the latter, to support cattle or crops — questions about the rationale for and consequences of choices among competing land uses have been addressed by a number of investigators (Bajracharya 1983; Joss et al. 1986; Wolf 1986; Box 1990; Pimentel 1992).

Except under unusual circumstances land is a scarce resource. It is therefore frequently an object of competition and a source of intergroup conflict (Foweraker 1981; Bennett 1988; Castro 1988; Ghee and Valencia 1991; Agarwal 1994). An important factor affecting relative land scarcity as well as ways in which land is husbanded derives from land tenure institutions, and these relationships have been given considerable attention by researchers (Newman 1981; Bruce and Fortmann 1988; Thiesenhusen 1989a, 1989b, 1991; Barlow 1991; Cernea 1991) as have efforts to reform land tenure institutions (Eckholm 1979; Dorner and Thiesenhusen 1979; Prosterman and Riedinger 1987).

Doubtless the most extensive body of research regarding land as a natural resource is focused on agricultural issues. During the past three decades a number of scholars have debated the effects of population increase on agricultural innovation and productivity (e.g., Boserup 1965; Robinson and Shuter 1984; 1985; Bilsborrow 1987, 1992; Okafor 1987; Bilsborrow and Geores 1994; Ruttan 1993b; Wolman 1993). Others have raised questions about the sustainability of contemporary agricultural institutions and practices in developing countries (Hrabovszky 1985; Brown 1987; Clay and Lewis 1990; Crosson 1992; Mahtab and Karim 1992; Biswas 1993, 1994; Ruttan 1993a), often focusing on the effects of changes in agricultural technology (Pingali and Bingswanger 1987; Coxhead and Jayasuriya 1994). Over the last decade or so a heated debate has arisen over the future of food production. Although the issues are complex, the fundamental question is whether sufficient food can be produced to feed the human population in light of a deteriorating agricultural resource base and changing food preferences (Brown 1985, 1989, 1995; Johnson 1984; Bradley 1986; Srinivasan 1987; Hendry 1988; Pimentel and Hall 1989; Pimentel 1991; Bohle and Krüger 1993; Ehrlich and Daily 1993; Döös 1994; Dyson 1994; East-West Center 1994; Kendall and Pimentel 1994; Goodman and Watts 1994; Smil 1994, 1995).

The world’s geopolitical regions, as well as particular countries, reflect a wide variety of land-related issues and problems. Recent studies focused on Africa include the following references: Ibrahim 1987; Castro 1988; Clay et al. 1988; Downs and Reyna 1988; Ellis and Swift 1988; Biot and Stocking 1989; Ford and Brown 1990; Kline-Cole et al. 1990; Cleaver and Gotz 1991; Agbo et al. 1993; Bruce et al. 1993; Lutz and Holm 1993; Mortimore 1993; Conelly 1994; Hansen 1994; Holgrem et al. 1994; Homewood 1994; Kreuter and Workman 1994; and

While the connection between land resources and development has been an issue at least since the time of Malthus, widespread recognition of the critical role of water is more recent. Nonetheless, over the past decade a number of comprehensive assessments have been published (Hanke 1984; White 1984; Rogers 1985; Falkenmark 1986; Maltby 1986; la Rivière 1989; Frederick 1990; L’Vovich et al. 1990; Clarke 1991; Falkenmark and Widstrand 1992; Postel 1992; Gleick 1993a, 1993d, 1993e; Shiklomanov 1993; Anderson 1995).

As in the case of land resources, some common themes have emerged. Several studies are focused on the characteristics and functions of different types of aquatic ecosystems, e.g., freshwater systems (Schwarz et al. 1990; Teels 1990; Carpenter 1992; Covich 1993; Falkenmark 1994a, 1994b; Jansson et. al. 1994) as opposed to coastal and marine ecosystems (Walker 1990; Carpenter 1992). One investigator (Gleick 1993c, 1994) has emphasized the connections between energy and water resources. Paralleling analyses of land issues, water resource researchers have argued that water scarcity is an important constraint on development (Ayibotele and Falkenmark 1992; Falkenmark and Lindh 1993; Postel 1993a, 1993b) and a source of intergroup conflict (Starr 1991; Gleick 1993b). Given increased demands on water resources in the developing world, questions about sustainability are now being raised (e.g., Falkenmark and Adiwoso Supropto 1992; Engleman and LeRoy 1993). While agriculture and food production define the principal issues regarding land sustainability, in the case of water resources an emerging parallel concern centers on fishing. Some researchers suggest that fish catches in many parts of the world have reached or already exceed the limits of sustainable withdrawal (Wise 1984; Gordon 1990; Rice 1991; Sherman 1995; Soegiarto 1995). Finally, a few studies have examined the influence of population growth on the distribution and use of water resources (e.g., Nelson and Sandell 1990; Weber 1994).

Perhaps because of the relative recency of interest in and concern over the effects of water resources on socioeconomic development, the literature focused on regional and national conditions and trends is relatively small. Relevant studies are available for Africa (Falkenmark 1989b), the Middle East (Neff and Matson 1984; Starr and Stoll 1988; Falkenmark 1989a; Lowi 1993), and Asia (Smil 1979, 1993; Edmonds 1994a, 1994b; Liu and Tan 1994; Zhang et al. 1995).

The literature on forest resources, and the process of deforestation in particular, is enormous. Reviews of the major issues are found in Sedjo and Clawson 1984; Mather 1987, 1990; Fortmann and Bruce 1988; Westoby 1989;
Hagenstein 1990; Myers 1991, 1992b and Sharma 1992. Much of the recent analysis has been focused on tropical forest regions (Guppy 1984; Myers 1986; Burley and Hazelwood 1988; Proctor 1988; Browder 1990; Collins 1990; Lugo 1992; Burgess 1993; FAO 1993; Grainger 1993b, 1993c; Bowman 1994). Some writers have emphasized the heavy dependence of developing country populations, particularly the poor, on the forests (Chambers and Leach 1989; Grimes et al. 1994; Adger et al. 1995). Increasingly, there is evidence of intergroup conflict over forest resources (e.g., Bunker 1985; Hall 1989) and of their abuse by commercial interests (Douglas et al. 1993). In some, probably many, areas it would appear that carrying capacity has been surpassed (cf. Fearnside 1986, 1990b; Gadgil and Guha 1992; Smil 1993).

The most visible and publicized issue regarding developing country forests is the process of deforestation. The overall trend is well-known (Bowonder 1985; Richards and Tucker 1988; Williams 1989; FAO 1993) and many investigators have sought to identify underlying causes (Allen and Barnes 1985; Fearnside 1987; Klein and Perkins 1987; Walker 1987; Deneven 1988; Laarman 1988; Rudel 1989; A.B. Anderson 1990; Cruz and Cruz 1990; Rowe et al. 1992; Grainger 1993b; Jarosz 1993; Moran 1993; Mendelsohn 1994; Schmink 1994). Major concerns include the effect on fuelwood supplies for the poor (Anderson and Fishwick 1984; Dewees 1989; Leach and Mearns 1989), other monetary and socioeconomic costs (Browder 1988; Ives and Pitt 1988; Barbier et al. 1990; Halhead 1992; Barbier 1993), and related ecosystem consequences (Hamilton and Pearce 1988).


Biodiversity (including extinction of species) is a relative latecomer to the pantheon of natural resource issues. Nonetheless, scholars have reviewed the central issues (e.g., Eckholm 1978; Myers 1979, 1983a, 1987, 1995; Wilson 1985, 1989, 1992; Yeager and Miller 1986; Worton 1986; Wilson and Peters 1988;
Nelson and Sarafin 1992; World Conservation Monitoring Centre 1992; Hoyle 1993; Edwards 1995; Pimm et al. 1995). Generally, three sets of issues have been examined. First, some writers have emphasized the intrinsic benefits of maintaining a high level of biodiversity (e.g., Prescott-Allen and Prescott-Allen 1982; Oldfield 1989; Soejarto and Farnsworth 1989; Ehrlich and Ehrlich 1992; Perrings et al. 1992; Sedjo 1992a; Toledo 1992). Second, various estimates have been offered (and challenged) regarding the rate and level of extinction of differing species in various parts of the world (Ehrlich and Ehrlich 1981; Myers 1988, 1990; Pimm et al. 1988; Diamond 1989; Arroyo et al. 1992). Third, various causes of species loss have been identified, including, for example, industrialization and development (Eltringham 1984), deforestation (Botkin and Talbot 1992), and pesticide use (Avery 1995).
A. Natural Resource Theory


Catton, Jr., W.R. 1976. “Why the Future isn't what it Used to be (And How it could be Made Worse than it has to be).” Social Science Quarterly 57 (September): 276-291.


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Simon, J.L. 1981a. "Environmental Disruption or Environmental Improvement?" *Social Science Quarterly* 62 (March): 30-43. [Also see P.R. Ehrlich, 1981a, 1981b, supra.]


B. Resource Stocks and Flows: Overview


C. Resource Issues I: Non-Fuel Minerals and Energy


D. Resource Issues II: Land, Water, Forests, and Biodiversity


Lefèvre, T. O'Riordan, and F. Praderie. Cambridge: Cambridge University Press.


Lefèvre, T. O'Riordan, and F. Praderie. Cambridge: Cambridge University Press.


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III. Ecological Impacts of Third World Development

The materials presented in the preceding chapter examine the role of natural resources in the development process and tend to focus on questions of resource availability and use in developing regions. Stated otherwise, environmental conditions and trends are viewed as independent variables affecting socioeconomic development. In contrast, the studies cited in Chapter III turn this relationship on its head; they are concerned with the effects of development on the environment. More specifically, this body of theory and research identifies linkages between the processes and outcomes of development-oriented activities and various indicators of environmental quality.

Space limitations preclude coverage of all dimensions of environmental quality, even if confined to the situation in the developing world. A comprehensive inventory would include studies of various manifestations of natural resource degradation and disruption of ecosystem functions, ranging from localized symptoms such as soil, water, and air pollution to changes in the biosphere as seen in ozone depletion and the accumulation of greenhouse gases. This chapter is limited to four topics. The materials contained in Section A provide a broad overview of the environmental impacts of development, while Sections B, C, and D cover specific manifestations of these development-linked alterations to the physical environment.

An understanding of the evolution of concern about global issues of environmental quality can be gained from selected studies listed in Section A. Key citations include Ward and Dubos' *Only One Earth*, the unofficial background document for the 1972 U.N. Conference on the Human Environment; Worldwatch Institute founder Lester Brown's *The Twenty-Ninth Day* (1978); *Our Common Future* (1987), the final report of the World Commission on Environment and

Materials contained in this first section of the chapter also address more specific issues of environmental quality. One set of studies is focused on specific ecosystem conditions, including environmental chemistry (Eisenbud 1990; Houghton and Skole 1990; Husar and Husar 1990; Smil 1990; Brown et al. 1990), water quality (Falkenmark 1991; Frederick 1992; and Nash 1993), soil quality (Schnoor and Thomas 1994), biotic diversity (Schlesinger 1994), and natural disasters (Wijkman and Timberlake 1989). Another key topic is reflected in the search for development-related causes of ecosystem pollution. Commonly recognized candidates include energy consumption (Darmstadter 1992), industrial production (Brown et al. 1990; Ayres et al. 1992; Robins and Trisoglio 1992; Nriagu 1994; Thomas and Spiro 1994), mining activities (Young 1992b; Grösser et al. 1994), international trade (Leonard 1988; French 1993), transportation technology (Hart 1994), and population growth (McNicol 1984; Pulliam 1988; Shaw 1988, 1989). Implications of environmental pollution for global security are discussed by Mathews (1989) and Myers (1993b).

Finally, studies of the effects of development on environmental quality are available for the various geopolitical regions of the world. Conditions in African countries are found in reports by Berry et al. (1990), Udo (1990), Falkenmark (1991), Berg et al. (1992), Mayo and Mashauri (1992), Woube (1994), and Swearingen and Bencherifa (1996). For Asia, data are provided by Smil (1984, 1993), Brookfield et al. (1990), Zhou and Zhang (1990), He (1991), Rodhe et al. (1992), Wenyong (1992), and Tonna (1995). Among the many studies pertaining to Latin American countries are studies by Collins (1986), Ezcurra (1990), Salat et al. (1990), Grösser et al. (1994), and Murray (1995). Although the areas of the former Society Union and Eastern Europe are not usually included among developing nations, examination of the conditions underlying their problems of environmental quality can yield useful lessons for the developing world (see Alayev et al. 1990; Badenkov et al. 1990; and Debardeleben 1991).

The citations contained in Section B are focused on issues of atmospheric
quality and climate change. Over the past two decades these phenomena have become recognized as truly global problems (National Academy of Sciences 1979, 1982, 1989; Vitousek 1989; Elsom 1992; Golitsyn et al. 1992; Graedel and Crutzen 1993; World Resources Institute et al. 1992; Watson and Chow 1994). In spite of some claims to the contrary (e.g., Goklang 1995), many studies have identified problematic, if not alarming, changes in atmospheric chemistry that appear to be the result of various modes of human activity (Woodwell 1989; Graedel and Crutzen 1990; Houghton and Skole 1990; Smil 1990a, 1991; Woodwell and Houghton 1990; Ayres et al. 1994; Loganathan and Kannan 1994; Prinn 1994). Stated otherwise, socioeconomic development --- as seen in increased energy consumption, material production, and ecosystem transformation --- is linked to alterations of the biogeochemical cycles, based on flows of carbon and nitrogen, that determine the chemical composition of the atmosphere and form the basis of the human life support system. In turn, these chemical changes are believed by many observers to have the potential to yield enduring shifts in regional and global weather patterns (Houghton and Woodwell 1989; Wirth 1989, 1991; Easterling 1990; Mintzer 1990; Woodwell 1990; Ausubel 1991; Schneider 1994; Root and Schneider 1995).

Current atmospheric changes are evident in regional problems of acid rain (McCormick 1985; Galloway et al. 1987; Regents and Rycroft 1988; Rodhe and Herrera 1988; Wellburn 1988a, 1988b; Cowling 1991) and depletion of the Antarctic ozone layer (Roan 1989; Solomon 1989; Gribbin 1990). In the long run, however, much more serious consequences for human society have been linked to global warming, the hypothesized effect of increased levels of carbon dioxide and other greenhouse gasses in the atmosphere (Mintzer 1987; Firor 1988; Abrahamson 1989a, 1989b; Broeker 1989; Falk and Brownlow 1989; Hansen 1989; MacDonald 1989; Schneider 1989a, 1989b, 1989d; Arrhenius and Waltz 1990; Gribbin 1990; Leggett 1990; Smil 1990b; Schelling 1992; Schmandt and Clarkson 1992; Ungar 1992; Beckerman and Malkin 1994; Balling 1995; Moore 1995). Examination of this literature will show that the issues surrounding global warming are far from clear, and conclusions are highly tentative.

Nonetheless, a growing body of research and analysis seeks to discover the human causes and consequences of atmospheric and climate change. Among the principal causes identified to date are activities that result in increased emissions of carbon dioxide (National Academy of Sciences 1979, 1982, 1989; Carbon Dioxide Assessment Committee 1983; Buzzaz 1990; Manabe et al. 1994; Moomaw and Tullis 1994; Mooney and Koch 1994), including biomass incineration (Andreae 1991; Woodwell, 1992), automobile use (Ross 1994), and shifting patterns of land use (Southworth et al. 1991). Though the linkages are indirect, population growth is also seen as an important contributor to atmospheric and climate change (Galloway 1986; Birdsall 1992; Bongaarts 1992; Orr 1992; Bartiaux and van Yepersele 1993; Galloway et al. 1994; Parikh and Painuly 1994).
A variety of consequences for human life and social organization have been attributed to atmospheric change (Topping 1992). Specific effects include threats to human health (World Health Organization 1992; Gayle 1993b), various impediments to the sustainability of economic growth and the maintenance of economic systems (Barbier 1989; Beckerman 1991; Nordhaus 1991a, 1991b, 1991c; Broome 1992; Cline 1992; Morisette and Rosenberg 1992), preservation of biodiversity (Peters 1989a, 1989b), disruption of agricultural systems (Bohle et al. 1994; Reilly et al. 1994; Rosensweig and Parry 1994), and---linked to global warming---the anticipated rise of sea level (Broadus 1989; Titus 1989). More generally, analysts have pointed to increased problems of international security (Brown 1989), maintenance of global carrying capacity (Downing and Parry 1994) and sustainable development (Obasi 1992; Andrews and Dickenson 1995), and political capacity to mount an effective response to underlying causes of changes in the global atmosphere and climate (Glantz 1989; Gleick 1989).

Because of the global implications of alterations of atmospheric chemistry and climate, relatively few studies have been focused on regional and national effects. Nonetheless, it is widely recognized that some areas, e.g., coastal regions subject to inundation from a rise of sea level, will be more affected than others. Moreover, significant climate shifts could result in either improvement or deterioration of nations' agricultural conditions. These and related issues are discussed in studies focused on Africa (Lockwood 1986), Asia (Smil 1984; Zhao and Sun 1986; Barron and Hills 1990; Perlack et al. 1993; Andréen et al. 1994; Chaturvedi 1994), and Latin America and the Caribbean (Liverman 1990, 1992; Liverman and O'Brien 1991; Brenes Vargas and Saborio Trejos 1994).

The contributions of land and forest resources to the development process are discussed in detail in the literature cited in Chapter II, Section D. However, another critical research issue concerns the ways in which socioeconomic development generates land degradation, in general, and desertification in particular. Section C of Chapter III is devoted to this topic.

Over the past decade or so a number of overviews of land degradation issues have been published (Brown and Wolf 1984; Blaikie 1985; Blaikie et al. 1987; Warren and Agnew 1988; Douglas 1990; Stryker 1990; Barrow 1991; Hanson and Lindh 1993; Pimentel 1993; Zhao 1994). They usually argue that this phenomenon constitutes a continuum, ranging from mild soil erosion---experienced in all countries---to severe desertification, a condition found in a limited number of locations in which there is irreversible loss of primary productivity and/or species diversity. A wide range of factors has been implicated as primary or contributing causes of land degradation, including natural hazards, population growth and movements, land tenure patterns, poverty, political instability, overgrazing, and inappropriate agricultural technology and practices (Conant 1982; Blaikie et al. 1987; Abel and Blaikie 1989; Southgate 1990; Barrow 1991; Pimentel 1993; Coxhead and Jayasuriya 1994). Less attention has been
given to the consequences of land degradation (but see Caldwell 1975, 1984).

Because land degradation is a common occurrence in the developing world, studies are available for countries representing all major geopolitical regions. Examples from Africa include: Caldwell 1975, 1984; Cook 1983; Beinhart 1984; Downs and Regna 1988; Biot et al. 1989; and Stahl 1993. Discussion of Asian issues is found in Smil 1984, 1993; Repetto 1986; and Blaikie 1988. Analyses of land degradation problems in Latin American and the Caribbean are reported by Bedoya 1987; Liverman 1990; Millikan 1992; Southgate and Whitaker 1992; and Zimmerer 1993.


While arid lands — thus prone to desertification — are found on all continents, the large majority are located in Africa and Asia. Therefore it is to be anticipated that desertification studies reflect this geographic distribution. The bulk of recent research has been focused on Africa (National Academy of Sciences 1975; Swift 1977; Franke and Chasin 1980; Adelfolalu 1983; Anderson 1984; O'Leary 1984; Steeds 1985; Thomson 1985, 1988; Wijkman and Timberlake 1985; El Moghraby et al. 1987; Garse and Steeds 1987; Glantz 1987; Starr 1987; Watts 1987; Ahkrona 1988; Kebbede and Jacob 1988; Mortimore 1988, 1989; Hulme 1989; Lo and Sene 1989; Fratkin 1991; Olsson 1993) and Asia (Schultz 1982; Fullen and Mitchell 1994).

In Section D attention shifts to the effects of development on the human-constructed environment as reflected in human settlements. With a few exceptions, the materials cited are concerned with the urban environment. While it is obvious that social and economic changes have also affected the environmental quality and settlement patterns of rural areas, the issues raised are substantively different and perhaps less complex. Moreover, because the significant rates of change — demographic, economic, social, cultural and political — are markedly higher in developing country cities than in the hinterlands, their environmental effects are more diverse and potentially more disruptive. Finally, the focus on
urban settlements is justified by UN estimates showing that by the turn of the century over half the population of developing countries will be living in urban localities.

Over the past two decades the literature on world, and particularly LDC, urbanization has grown rapidly (Berry 1973, 1990; Beier 1976; Ward 1976; Hawley 1981; Gilbert and Kugler 1982; Linn 1983; Gwynne 1985; Hardoy and Satterwaite 1986, 1989c; Brown and Jacobson 1987a, 1987b; Burton 1988; World Resources Institute et al. 1990; Bairoch 1991; Kasarda and Crenshaw 1991; Lowrey 1991; Hardoy et al. 1992b; Findley 1993; Kasarda and Parnell 1993). While the majority of this work has been concentrated on demographic and socioeconomic causes and consequences of rapid urbanization, it is increasingly evident that major threats to the sustainability of urban development stem from accompanying degradation of the physical environment.

Demographic analyses of third world urbanization have highlighted several principal issues. One concerns the problem of institutional adjustment to the sheer rate of urban growth (Newland 1980; Selvaratnam 1994), which is seen to be particularly serious in the increasing number of megacities (Nagpaul 1988; Sachs 1988; Teune 1988; Cohen 1993; Richardson 1993). The personal and social consequences of high-density living continue to receive attention (Hawley 1972; Pendakur 1993) as does the role of migration in city growth (Chapman 1981; Roberts 1989; Goldstein 1993). Finally, some scholars have kept alive the debate over the consequences of “overurbanization” (Gugler 1988) and “urban primacy” (Frey et al. 1986).

Another body of research has been focused on the social and economic organization of cities. Among the principal topics are economic growth processes (Kelley and Richardson 1984; Oberai 1993; Sit 1993), job creation (Singh 1992; Rondinelli and Kasarda 1993a), and poverty (Hardoy and Satterwaite 1984; Campbell 1990; Gilbert 1994b). Provision of housing for the growing urban population has emerged as a critical issue (Hardoy and Satterwaite 1981; Stokes 1981; McAustan 1985; Brennan 1993) along with the longstanding interest in the organization of squatter settlements (e.g., Leeds 1969; Kentor 1981). Problems of urban transportation in the developing world are recognized, but require increased attention (cf. Lowe 1990).

The literature cited in the preceding paragraphs represents the usual concerns of social scientists with regard to Third World urbanization. Increasingly, however, the implications of urban growth and socioeconomic organization are interpreted within the conceptual framework of the ecosystem, resulting in a shift of attention to problems of the nonhuman environment. A number of overviews

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2 Megacities are typically defined as those with a population of 10 million or more inhabitants.

Concern over the issues mentioned above has produced a number of discussions of the need for reconsideration of urban policies in the developing world (Ward 1976; Dewar and Watson 1986; Lowe 1991, 1992; World Bank 1991; Perlman 1992; Rondinelli and Kasarda 1993b). Existing policies are seen as nonresponsive to emerging problems, particularly with regard to the environmental effects of modernization and development.


In addition to the regional and national research cited above, a number of case studies or profiles have been prepared for major cities in the developing world. Analyses are available for Accra (Amuzu and Leitmann 1994), Bombay (Harris 1988), Cairo (Khalifa and Maheiddin 1986), Delhi (Nagpaul 1988a), Hong Kong (Yeung 1992), Khartoum (El Sammani et al. 1989), Jakarta (Hadiwinato and Leitmann 1994), Lagos (McNulty and Adelema 1988), Manila (Jiménez and Velásquez 1989), Mexico City (Schteingart 1988, 1989; Pezzoli 1991, 1993), Sao Paulo (Faria 1988; Kowarick and Campanario 1986), Shanghai (Murphey 1988; Hodder 1993), and Singapore (Kong and Yeoh 1994).
A. Environmental Quality and Development


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B. Atmosphere and Climate


“Reading the Patterns.” The Economist (1 April 1995): 75-77.


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C. Land Degradation and Desertification


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D. Human Settlements


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IV. Planning for Sustainable Development

In spite of the considerable attention given to the idea of sustainable development, the means for its achievement remain a subject of highly charged debate and enormous controversy. Needless to say, any effective strategy for ensuring sustainability must come to grips with problems of resource depletion and environmental degradation. But this accomplishment will require actions that eliminate not simply the symptoms of environmental destruction, but also their direct and indirect causes, which are intertwined with the process of development itself. In short, the achievement of sustainable development will involve a fundamental reorganization of human society.

At present there is no generally accepted blueprint for achieving the sustainable society, though blame for this situation is surely not due to lack of effort. An impressive number of scholars, policymakers, and planners has produced an enormous literature, largely over the past two decades, outlining an incredible variety of strategies and tactics believed to contribute to the quest for sustainability. This final chapter provides citations to a sizeable sample of these writings.

Section A includes materials that identify the major obstacles to sustainability and the general strategies that have been proposed to overcome them. Detailed coverage of the literature on sustainable development was presented in Chapter I, Section C. Nonetheless, it is useful to include here a number of items that point specifically to the variety of obstacles assumed to stand in the way of sustainability (Dorfman 1985; Brown 1986; Redclift 1987; Brown et al. 1988; Barrett 1991; Helm 1991; Helm and Pearce 1991; Maler 1991; Mathews 1991b; Smith and Warr 1991; Stern et al. 1992; Tolba et al. 1992; Middleton et al. 1993; Stone 1993; Park 1994; Smith 1995).

Several general categories of deterrents can be identified. One set reflects conceptual and ideological differences that separate ecological from economic
approaches to development policy (Daly 1977, 1989b; Carpenter and Dixon 1985; Nijkamp and Soesteman 1988; Redclift 1988; Commoner 1989; Lombardini 1989; Kassiola 1990; Henderson 1991; Daly and Cobb 1994; Common 1995). These differences are reflected not only in the approaches of development specialists, but also in the dominant values and beliefs of contemporary culture. Other writers have identified barriers to sustainability that reside in the international economic system, including international debt (Adams 1991), mechanisms for financing development (Holmberg 1992), and the arrangements through which more developed nations provide assistance to the less developed world (Linear 1985; Ivory 1992). Still others emphasize the characteristics of the national political systems of developing countries, e.g., the presence of military regimes (Alario 1993; Gasser 1995), weakness of political leadership (Cuccia 1989), and resistance to the adoption of effective population (Keyfitz 1992; Gulhati and Bates 1994) or environmental (Harrison et al. 1982) policies.

In recent years many studies have appeared that locate the principal barriers to sustainability in what is generally referred to as the international system. While definitions of this term vary, it reflects the network of structural and functional connections among nations, including international organizations. According to this perspective, major obstacles to sustainability result from the inability or unwillingness of nations to work collectively in the human interest. One set of studies addresses questions about the degree and consequences of conflict over control of natural resources (Choucri and North 1975; Connelly and Perlman 1975; Midlarsky 1982; Catton 1983; Naff and Matson 1984; Westing 1984, 1986; Schnaebel et al. 1986; Nossiter 1987; Mandel 1988; Homer-Dixon 1991, 1993, 1994; Choucri and North 1993; Gedicks 1993; Gleick 1993; Lowi 1993; Sprinz and Vaahktorreta 1994). Others have located the problem in weak or conflicting international regulatory regimes and policies, with special attention to those pertaining to the environment (Caldwell 1990a; Chayes and Chayes 1991; Birnie 1992; Haas with Sundgren 1993; Brown et al. 1994; Conca et al. 1995; Miller 1995). A third approach points to difficulties in ratifying and/or verifying international environmental agreements (Ausbuhl and Victor 1992; Spector and Korala 1993). In recent years a number of critics have shifted attention to problems with the operation of multilateral institutions, such as the United Nations and the World Bank, and international conferences such as the UNCED (Rich 1990, 1994; Documents 1992; Mikesell and Williams 1992; Grubb et al. 1993; Chatterjee and Finger 1994; Taylor 1993; Daly 1994; French 1994). Finally, another body of literature raises questions about the notion of national security, asking whether the interests of sustainable development might be better served by thinking in terms of global security, which would place heavy emphasis on the urgent need for much improved environmental management (Brown 1977, 1985a; Deudney 1983, 1990; Myers 1986, 1989a, 1993c; Gore 1989; Mathews 1989; Renner 1989; Bruntland 1993; Dewitt 1993; Ehrlich
et al. 1993; Romm 1993; Weiss and Holdgate 1993; Porter 1995).


Sustainable development strategies can be grouped into two broad categories. One set consists of interventions that can be adopted by national governments or smaller localities. First, there are efforts to change the ways people think about the environment and its role in development. Examples include ecological education (Clark 1991; Zuchetto 1991; Meadows 1992; Grove-White et al. 1992; Finger 1994; Hägvar 1994; Mattoo and Singh 1994), “green marketing” (Plant and Plant 1990; Hawken 1993), and the “precautionary principle,” which emphasizes the risks of not making all reasonable efforts to preserve ecosystem integrity (Gray and Rivkin 1991; Perrings 1991; Myers 1993a; Warren 1993). A related strategy would employ the power of the mass media to increase environmental awareness (Lemay and Dennis 1991; Ryan 1991; Shrestha 1991).

A second group of strategists, taking seriously the interdependence assumption underlying the ecosystem perspective, has promoted the idea of integrated development planning with particular attention to ecosystem protection (Tiezzi et al. 1991; Lutz and Young 1992; Bardhan 1993; Brechin et al. 1994; Kismadi 1994; Panandiker 1994). A third approach is intended to overcome the ecological damage presumed to result from the current volume and intensity of economic production of industrial societies. It calls for a fundamental reorganization of the economic system in order to preserve the stock of natural

A fourth blueprint for sustainability rests on faith in the efficacy of science and technology. Concepts such as industrial ecology have been created to reflect the idea that industrial production and even economic growth can be environmentally benign if the appropriate technological innovations are implemented (Norman 1978; Holt and Rawlins 1990; Heaton et al. 1991, 1994; Mitch 1991; Drooge et al. 1992; Gurgulino de Souza 1992; Juma and Sagoff 1992; Lang et al. 1992; Simonis 1992; Skolnikoff 1993; Tiffin and Mortimore 1994). Science and technology are also seen as mechanisms for making agriculture ecologically sound (Brown 1987; York 1988; Young 1989; Wimberley 1993; Saltiel et al. 1994).

Fifth, many analysts continue to believe that population management is a necessary condition for a sustainable society. This includes not only the control of fertility and population growth, but also the rational allocation of population distribution and migration (Bobrow 1977; Newland 1977; Stokes 1977, 1980; Brown 1983, 1984c, 1985b; Jacobson 1983, 1987, 1990; Brown and Jacobson 1986; Pearce 1991a; Birdsall 1994; Blaikie 1994; Henson 1994; Johnson 1994).

Finally, several related strategies are based on the idea that sustainable development and environmental management cannot be left in the hands of governments and other elites. According to this viewpoint, popular participation is a prerequisite for innovations that will truly serve the public interest. There is a variety of ways in which sustainability can be pursued through collective action. One is to involve nongovernmental organizations (NGOs) and public advocacy groups in the design, implementation, and evaluation of development projects (Milbrath 1984; Norton 1991b; Bramble and Porter 1992; Lindborg 1992; Sand 1992; Fisher 1993; Dalton 1994). Another strategy is based on the assumption that local people understand their problems and, if given the opportunity and necessary resources, can devise sustainable solutions (Stokes 1978; Sharp 1992; Friedman and Rangan 1993; Massaro 1993; McDonald 1993; Melone 1993; Rangan 1993; Burningham and O'Brien 1994; Cvetkovich and Earle 1994; Eale et al. 1994; Hyndman 1994). Moreover, some analysts believe that indigenous knowledge is a valuable and often overlooked commodity (DeWalt 1994). Finally, increasing attention is being given to the unique contributions available from women's organizations (Dankelman and Davidson 1988; Southeimer 1991; Dogramaci 1992; Jackson 1994).

The second major category of sustainable development strategies is focused on relations within the international system. These approaches are

Another approach seeks to alter the basis of international trade in order to alleviate its environmentally damaging consequences (Arden-Clarke 1993; Victor et al. 1993; Ward 1993; Westcoat 1993; Cameron 1994; Daly and Goodland 1994a, 1994b, 1994c; Bredahl et al. 1996). A third avenue would rationalize the policies and practices of the more developed nations pertaining to development and the environment. This would include aid provided to developing countries and contributions to preservation of the global environment (Mathews 1991c; Schor 1991; Cooper 1992; Gore 1992; Hagerty 1992; Maull 1992; Naugh 1992; Repetto 1992; Chad and Stone 1993; Potter 1994; Rubi et al. 1994). An often neglected component of this approach is transfer of environmentally benign technologies (Fri and Cooper 1992).

A final strategy focused on the international system emphasizes the need for more effective forms of international environmental law (Palmer 1992; Susskind and Ozewa 1992; Susskind et al. 1992; Weiss 1993; Pallemaerts 1994; Sands 1994a, 1994b, 1994c; Scherr and Blumenfeld 1994; Susskind 1994; Tarasofsky 1994; Werksman 1994; Whelling 1994). There is a particular need for regulatory mechanisms that are both just and enforceable.

Several studies have addressed the issue of obstacles to and strategies for sustainable development in specific regional and national contexts. Discussions focused on Africa include Brown and Chandler 1986 and Njiti and Sharpe 1994. For Asia, one can consult Smil 1984, 1993; Lo 1989; Ross 1992; Brandon and Ramankutty 1993; Jasanoﬀ 1993; Lindsay 1993; Montgomery 1993a, 1993b; and Weiskel 1993. Informative analyses of the situation in Latin American and the Caribbean include Cavalcanti 1991; Cleary 1991; Economic Commission for Latin America 1991; List and Rittberger 1992; Muñoz 1992; Documents 1993; and MacDonald et al. 1996.

The materials cited in Sections B and C cover more specific efforts to address the environmental dimensions of sustainable development strategies. Those contained in Section B pertain to the management of natural resources.
variety of publications over the past couple of decades provide overviews of the many issues that have been raised and the strategies that have been proposed or implemented (Pindyck 1978; Brown 1979; Dolman 1980; Dorner and El-Shafee 1980; Dunkerley and Whitehead 1983; Hussain and Chowdhury 1984; Lowe et al. 1986; Soulé 1986; Hanson and Erbaugh 1987; Roth 1987; Roy 1987; Southgate and Disinger 1987; Southgate and Hitzhuzen 1987; U.S. Agency for International Development 1987; Chau 1988; Dreadman and Turner 1988; Pearce 1988; Pearce and Marykanda 1989; Ascher and Healey 1990; Kamienicki and Sanasarian 1990; Barbier 1991a; Brussard 1991; Reiner 1991; Arrhenius 1992; Barbier et al. 1992; Reardon 1992; Pearce and Whitehead 1993; Pelsus 1993a; Pan 1994; Denniston 1995). The following discussion of the more focused literature will deal, first, with nonrenewable resources and then turn to those usually assumed to be renewable.

During the past decade or so there has been relatively little attention given to strategies to deal with non-fuel mineral problems (but see Eggert 1994). Discussions of recycling (Chandler 1983; Liegerat 1990; Young 1991; Young and Sachs 1994, 1995) and development of synthetic materials (Flavin 1980a) predominate. In contrast, a sizeable number of studies has been concentrated on global and, frequently, Third World energy resource strategies (Flavin 1987a, 1988b, 1992; Goldemberg et al. 1987; Jhirad 1990; Meier 1990; Schramm 1990; Wilbanks 1990; Flavin and Lenssen 1991, 1994a, 1994b; Gibbons et al. 1991; Hirst and Goldman 1991; Pimentel et al. 1991; Darmstadter 1992; Darmstadter and Fri 1992; Goldmark and LaRoccio 1992; Kats 1992; Office of Technology Assessment 1992; World Bank 1993b; Hills 1995).

Technological solutions to energy problems have received a great deal of attention. One set of discussions argues for development of new technologies to take advantage of renewable energy supplies (Hayes 1978; Deudney 1981; Flavin 1981, 1986, 1995; Koo 1987; Flavin and Postel 1984; Flavin and Pollock 1985; Shea 1988; 1988b; Flavin and Lenssen 1990; Hurst 1990; Ahmad 1994; Kozlowski and Shobowale 1994; Williams 1994). Another approach is to improve technologies for processing nonrenewable resources such as coal (Alpert 1991; Rose et al. 1991) and nuclear materials (Flavin 1987b; Hohenemser et al. 1990; Berkhout 1994) and, more generally, to increase the efficiency of energy extraction technologies (Chandler 1985a, 1985b; Flavin 1988a; Flavin and Durning 1988; World Bank 1993a; Gadgil 1994; Geller and Nadel 1994). Finally, a variety of innovations in energy policy have been recommended such as removal of subsidies (Kosmo 1987; Desai 1992), increased taxation (Sindair 1994), privatization (Sullivan 1990), and efforts intended to promote conservation (England 1994; Lenssen and Rodman 1995).

It is now generally agreed that, paradoxically, development activities and policies pose a greater threat to the viability of renewable natural resources. These concerns can be seen in the literature devoted to strategies for sustainable use of land, water, and forests, and for preserving biodiversity. Several studies provide
an overview of land management strategies (Sandford 1983; Rosenberg and
Freeman 1984; Wolf 1986b; Blaikie and Brookfield 1987a; Doebele 1987; Dixon
et al. 1989, 1990; Gow 1989; Postel 1989; Grainger 1990). Not surprisingly,
policies and programs pertaining to agriculture and food production have been
discussed extensively (Wolf 1986a, 1987b; Bennett and George 1987; Ghatak
1988; Brady 1989; Crossen and Rosenberg 1989; Ruttan 1989; Brown 1990;
Agrarian reform (Bromley 1989; Baños and Ramirez 1994) and the “livestock
economy” (Durning and Brough 1992) and additional examples of important land-
use topics. Another set of concerns is seen in discussions of land maintenance
policies, including ways to combat soil erosion (Beinhart 1984), and promote land
reclamation (Bradshaw and Chadwick 1980; Daily 1995), approaches to watershed
management (Brooks et al. 1992), and more general land conservation issues
(Brown 1984; Bernstein 1994). Some writers have advocated greater use of
indigenous knowledge (Durning 1992; DeWalt 1994) as a means of improving
land use practices.

In many parts of the developing world water resource problems pose a
major threat to continued development and economic growth. A variety of
discussions of water resource strategy and policy issues are available (Postel
1984b, 1985a, 1985b, 1986, 1990, 1992; Anderson 1985; Ayibotele and
Falkenmark 1992; Howe and Dixon 1993; McCaffrey 1993; World Bank 1993c;
Richley et al. 1995). More specifically, attention has been given to strategies for
watershed (Dixon 1989; Arya et al. 1994) and groundwater (Munasinghe 1991;
Provencher and Burt 1993) management and, in the agricultural sector, irrigation
water pricing (Sampath 1992). Forestry-based water protection strategies have also
been proposed (Hamilton and Pearce 1987), as have technologies for water
reclamation and recycling (Cummings and Burness 1982; Shuval 1987; Cáceres

Another important set of issues has to do with management of the world’s
oceans (Sanger 1986; Swanson 1991b; Stairs and Taylor 1992; Weber 1994b;
Jeffries 1995; World Bank et al. 1995) and fisheries (Kent 1979; Brown 1985;
Hammer et al. 1993; Charles 1994; Weber 1994a, 1995; Bayley 1995). Within the
latter topic, the alternative of aquaculture (Chan 1993; Beveridge et al. 1994) has
received increased attention. Finally, there is growing recognition of the urgent
need for regional coordination with regard to national and international water
policies (Dinar and Wolf 1994).

Due to the incontrovertible evidence of widespread deforestation around
the world, strategies and policies for protection of forest resources have been major
topics of discussion (Eckholm 1979; Clawson and Sedjo 1982; Hallsworth 1982;
Proctor 1984; Postel 1984c, 1985c; Anderson 1986; Cernea 1988, 1992; Gillis and
Repetto 1988; Postel and Heise 1988; Anderson 1990; Ascher and Healey 1990;
Barbier 1991b; Goodland et al. 1991; Postel and Ryan 1991; Miranda et al. 1992;

Finally, there has been increasing attention to the continued loss of biodiversity (Norgaard 1987; Wolf 1987a; Ledeò and Goodland 1988; Reid and Miller 1989; Swanson 1991a, 1992; Courrier 1992; Munasinghe 1992; Norton and Ulanowicz 1992; Ryan 1992a, 1992b; Rojas and Thomas 1992; Wells 1992; World Conservation Monitoring Centre 1992; Bishop 1993; Ehrlich and Daily 1993; Folke et al. 1993; Tobey 1993; Stahler 1994; Eiser et al. 1995; Knight 1995; Redford and Robinson 1995). Significant strategic problems include financing biodiversity protection (McNeely 1989, 1993) and development of effective procedures for landscape management (Pelliam 1995). Additional discussions of interest concern the relevance of indigenous knowledge for biodiversity preservation (Gadjil et al. 1993) and the utility of following the precautionary principle (Myers 1993).

Because of the enormous variation of natural resource conditions and trends within and between nations, an increasingly large regional and national literature has accumulated. Studies focused on the African situation include: Naff and Matson 1984; French 1986; Anderson and Grove 1987; Hyman 1987; Little and Brokensha 1987; Clay et al. 1988; Gillis 1988c; Abel and Blaikie 1989; Gould and Zobrist 1989; Newcomb 1989; Burnett and Stillwell 1990; Child and Heath 1990; Lowrey 1990; Gammelsrød 1992; Mgeni 1992; Ramberg 1992; Thomas-Slater 1992; Toumin et al. 1992; Bradley and McNamara 1993; Freudenberger 1993; Githinji and Perrings 1993; Hackel 1993; McNeely 1993; Richards 1993; Choker and Odemero 1994; Karekezi 1994; Larson 1994; Morgan and Solarz 1994; Njiti and Sharpe 1994; Vaishnav 1994; and Ribot 1995. For Asian countries, the following sources are available: Diaz 1982; Ross 1983, 1988; Lopez 1987; Boswonder et al. 1988; Gillis 1988a, 1988b; Li et al. 1988; Shiva and


In Section C the topic shifts to strategies for achieving and maintaining acceptable levels of environmental quality. Stated otherwise, these materials are concerned with interventions intended to preserve the life support system and to minimize the disposal of harmful wastes.


Among the several issues of environmental quality given particular attention in this Sourcebook, that pertaining to atmospheric and climate change has been the subject of an extraordinary debate over strategic approaches (Warwick

Strategies for halting land degradation and desertification (Nyerges 1982; Todros 1982; Falloux and Mukendi 1988; Postel 1989; Falkenmark and Rockström 1993; Lundin and Lindén 1993) and for improving human settlements (Richardson 1977; Hardoy and Satterthwaite 1981; Renaud 1981; Linn 1983; Rondinelli 1983; Shea 1987; Nentied and van der Linden 1988; Girardet 1993; Hardoy and Satterthwaite 1993; Bartone et al. 1994) are less clearly defined. One underlying factor may be that these latter issues are national and regional rather than global, and thus general approaches are much more difficult to develop.


The materials cited in the first three sections of this chapter reflect instrumental approaches to the prevention or management of environmental problems associated with societal development. In contrast, Section D covers


Others have examined the idea of environmental justice (Hubbard 1977; Heinegg 1979; Wenz 1988; Shue 1992; Bullard 1994; Clayton 1994; Ogotow 1994; Ogotow and Clayton 1994; Boermer and Lambert 1995). One important issue has to do with the nature and degree of responsibility current generations have for protecting the environment for future generations (Norton 1982; Page 1983; Solow 1986; Lippit and Ramada 1987; Weiss 1989; Howarth and Norgaard
1991; Howarth 1992). Another is seen in the debate over the rights of nonhuman species (Feinberg 1974; Katcher and Wilkins 1993; Shepard 1993; Calicott 1995; Rolston 1995).

Much of the dialogue over environmental ethics has been shaped by Western, developed nation, frames of reference. Nonetheless, several authors have approached the topic from the perspective of nonwestern, developing country styles of thought (Calicott and Ames 1989; Dwivedi 1990; Gudynas 1990; Sivaraksa 1990; Sui-Cheong and Kam-Kong 1990; Izzi Deen 1990; Omari 1990; Omono-Fadaka 1990; Maybury-Lewis 1992; Diamond 1993; Hallman 1994).
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Oxford University Press.


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Sustainable Development: Redefining Institutions, Policy, and Economics,

Resources for the 21st Century, eds. R.N. Sampson and D. Hair.

of Acute Conflict.” International Security 16 (Fall): 76-116.

Security." Pp. 185-228 in Building a New Global Order: Emerging


University Press.

the Environment: Actors, Interests, and Institutions, eds. A. Hurrell and

Interdependence of Cultural and Biological Diversity.” Human
Organization 53 (Fall): 296-302.

International Studies 17 (April): 201-212.


Press.

International Union for the Conservation of Nature, United Nations Environment
Strategy for Sustainable Living. Gland, Switzerland: IUCN.

Development 20 (7): 1061-1076.

Change, eds. B. Zaba and J. Clarke. Liége, Belgium: Ordina Publications.


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Nordhaus, W.D. 1991b. “To Slow or Not to Slow: The Economics of the

Nordhaus, W.D. 1994. Managing the Global Commons: The Economics of

Nyerges, A.E. 1982. “Pastoralists, Flocks, and Vegetation: Processes of
Co-Adaptation.” Pp. 217-247 in Desertification and Development:
Dryland Ecology in Social Perspective, eds. B. Spooner and H.S. Mann.

Organization for Economic Cooperation and Development. 1994. Managing the
Environment: The Role of Economic Instruments. Washington, DC: OECD.


357 in Industrial Ecology and Global Change, eds. R. Socolow, C.
Andrews, F. Berkhout, and V. Thomas. Cambridge: Cambridge University
Press.

Change.” International Affairs 68 (2): 293-310.

University Press.


Postel, S. 1987a. Defusing the Toxics Threat: Controlling Pesticides and
Industrial Waste. Worldwatch Paper No. 79. Washington, DC:
Worldwatch Institute.


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