



# The meaning of global environmental change

## Rethorizing culture in human dimensions research

James D. Proctor

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Culture is one of the most complex human dimensions of global environmental change; it is thus perhaps understandably the least well theorized. The objective of this paper is to sketch a conceptual framework for the role of culture in global environmental change in order to support the kinds of research necessary to shed light on this significant though elusive factor. I note limitations in how culture is conceptualized in current human dimensions research, and offer a retheorized notion of culture as a pervasive dimension of meaning in all social processes associated with environmental change, concluding with observations regarding research opportunities. © 1998 Elsevier Science Ltd. All rights reserved.

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Department of Geography, 3611 Ellison Hall, University of California, Santa Barbara, CA 93106-4060, U.S.A.

### Introduction

Contemporary human dimensions of global environmental change research represents a vibrant, multifaceted field which is nonetheless built around a relatively undeveloped theoretical core. It is clear that social scientists of all sorts have enlisted as full participants; and indeed in the late 1980s and early 1990s there was a great deal published around the question of just what constitutes human dimensions research (Arizpe, 1991; Burton and Timmerman, 1989; Clark, 1988; Miller and Jacobson, 1992; Price, 1990, 1992; Rockwell and Moss, 1992). The multidisciplinary nature of the field makes for difficulty, however, in tracing its key questions back through a particular theoretical heritage. If, for instance, all human dimensions research were performed by sociologists (a move the author, a geographer, certainly would not condone!), we could at least detect ways in which Weber, Marx, and more contemporary theorists were informing this work (Buttel and Taylor, 1994; Dickens, 1992; MacNaghten and Urry, 1995; Murphy, 1994).

Certain theoretical components of human dimensions research, however, span the social sciences, and as such could never be fortified by appealing to any one particular discipline. Such is the concept of culture, long known among social scientists as fundamentally important though in many ways elusive (Hall, 1993; Kroeber and Kluckhohn, 1952; Payne, 1996). Culture is quite arguably, in the words of Raymond Williams, 'one of the two or three most complicated words in the English language'. (Williams, 1983, p. 87). Statements such as this suggest that culture will not easily be incorporated into human dimensions research without careful explication of what precisely the term means and how culture is related to global environmental change.

At the same time, this theoretical challenge to human dimensions research can be turned on its head, as others have already observed (e.g., Miller, 1991, p. 615). Given the lack of disciplinary ownership of the concept of culture, multidisciplinary human dimensions inquiry may be uniquely qualified to further cultural theory, with implications spanning

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the entire range of the social sciences. This potential contribution will not occur, however, without correcting some rather ubiquitous mistaken assumptions about culture which have found their way into human dimensions research. There are three particular assumptions I wish to examine critically in this paper:

- *Separability*: That culture can be disentangled from, and analyzed as if it were essentially independent of, other human dimensions of global environmental change;
- *Methodological individualism*: That culture is, at least for the intents and purposes of social science, roughly equivalent to the attitudes and beliefs of individual persons; and
- *Externality*: That human dimensions research does not itself embody important cultural aspects worthy of analysis; i.e. it is external to the object of analysis.

The first part of this paper reviews how culture can be conceptualized in human dimensions of global environmental change research. I then sketch a retheorized conception of culture that corrects the three mistaken assumptions noted above, drawing some topical and methodological implications for human dimensions research. The culture concept has long been bedeviled by an idiographic impulse (i.e., one assuming that all instances of culture are unique and nonrepeatable); given its scope, research on human dimensions of global environmental change has the potential to conceptualize culture and its practical implications in a much broader way.

## **Culture in contemporary human dimensions research**

### *The place of culture*

Most human dimensions research is built on a simple interactive model between human and biophysical processes, in which human elements can be linked either to the *causes* or the *effects* (the latter typically consisting of both human impacts and responses) of global environmental change. In this schema, cultural factors are often cited alongside political, demographic, economic, and other human factors as candidate processes of relevance (Miller, 1991, p. 611).

The ways in which culture is conceived in human dimensions research can be traced in part by attending to specific references in the numerous research agendas that appeared around the turn of the 1990s, as well as by careful examination of actual human dimensions research initiatives. I will consider each in turn.

### *Research agendas*

The recommended engagement of human dimensions research with culture is quite variable though some regularities emerge, as evidenced in recent agendas. I will examine three research agenda statements in order: the book-length report of the US National Research Council's Committee on the Human Dimensions of Global Change, the research framework commissioned by the International Social Science Council's Human Dimensions Program, and an earlier International Geosphere-Biosphere Program prospectus on relevant human dimensions research (Jacobson and Price, 1991; Stern *et al.*, 1992; Clark, 1988). These will be referred to below as the NRC, ISSC, and IGBP studies, respectively.

The NRC study is the longest and most comprehensive treatment of human dimensions research priorities to appear to date. It is organized along the lines of the general rubric presented above, closing with a statement of priority theoretical and methodological issues. A broad range of human causes of and consequences/responses to global environmental change are included in the NRC agenda; the relationship between culture and global environmental change, however, is not well developed. Indeed, the book's index mentions culture only in the context of brief references to 'cultural factors' related to Amazonian deforestation (p. 36), 'cultural identity' as a possible factor in the human response to global change (p. 159), and 'cultural ecology' as one example of environmental social science (pp. 37–39).

A much more solid cultural feature of the NRC study is its discussion of attitudes, perception, and beliefs, cited as fundamental both to causes (pp. 89–92) and consequences/responses (pp. 131–136) related to global environmental change. Indeed, the agenda explicitly emphasizes not only the psychological (individual) but the cultural (shared) dimensions of these ideological factors as well. Examples given in the NRC study of culturally based ideas linked with environmental change include Lynn White's famous thesis that our contemporary environmental crisis is a result of the Judeo-Christian concept of nature, the feminist assertion that domination of nature is intimately linked with patriarchy, and the diffuse critique of values accompanying the spread of capitalism (Merchant, 1980; White, 1967; Worster, 1988). The human consequences/responses section, however, explicitly separates individual and cultural elements as a way of making the point that 'The human consequences of global change begin with the individual' (p. 131), primarily involving the aggregate perceptions, judgments, and actions of individual humans. Cultural elements are included as a part of the 'sociocultural system'; the main example discussed involves indigenous societies and how they may or may not adapt successfully to environmental change (pp. 140–142).

Cultural factors are given relatively little emphasis in the ISSC document. The ISSC framework prioritizes seven research topics ranging broadly from 'social dimensions of resource use' to 'energy production and consumption' to 'environmental security and sustainable development'. The framework links culture to these research topics only in the briefest of citations: for instance, 'cultural models of consumption' are mentioned (without elaboration) as one social dimension of resource use (p. 45), 'cultural background' is mentioned (again without elaboration) as a factor related to perception and assessment of global environmental conditions and change (p. 46), and 'cultural and historical contexts' are noted as potentially affecting social, economic, and political structures and institutions (p. 48). Thus, culture is not so much absent from the ISSC framework as entirely undeveloped. Given that any explicit mention of culture is absent from the initial HDP research agenda (Burton and Timmerman, 1989, p. 310), the ISSC document's treatment can perhaps be viewed as an improvement, though there clearly is much more that could have been said.

One quite carefully developed, though relatively early, example of a human dimensions research agenda was commissioned by the IGBP and coordinated by William Clark (Clark, 1989). Clark's framework for understanding human dimensions involves three components: interactions between society and the natural environment, choices that affect those

interactions, and underlying structural elements that shape both interactions and choices (p. 139). The IGBP document explicitly mentions culture as a major underlying context affecting these components. Yet the conceptualization of culture implied in the IGBP document is broad, involving 'the structure, distribution, and growth of human populations, the modes of social, political, and economic organization adopted by those populations, and the resulting state of agricultural, industrial, and general economic development' (p. 149). If this broad sweep of human processes is culture, then it is not surprising that culture figures so highly in the research strategy.

#### *Research initiatives*

One of the most ambitious projects designed to link human dimensions to environmental change is the Land Use/Land-Cover Change (LUCC) project, a joint project of the IGBP and the HDP. As summarized in its Science Plan (Turner II *et al.*, 1995), the LUCC project addresses five overarching questions (p. 8):

- How has land cover been changed by human use over the last 300 yrs?
- What are the major human causes of land-use change in different geographical and historical contexts?
- How will changes in land use affect land cover in the next 50–100 yr?
- How do immediate human and biophysical dynamics affect the sustainability of specific types of land uses?
- How might changes in climate and global biogeochemistry affect both land use and land cover, and vice versa?

The Science Plan mentions a number of candidate driving forces underlying land use/land-cover change at the local, landscape, and regional level. Values and expectations are included as a candidate local-scale driving force (Figure 7, p. 33), and as a component of integrated land use/land cover modeling (Figure 9, p. 43). Culture, however, is not explicitly included, other than as a 'context' element (p. 30). Indeed, one collaboratively devised typology of LUCC includes a total of eight political, economic, demographic, and environmental driving forces, though no cultural driving forces are explicitly included (McNeill *et al.*, 1994, p. 56). The explanation is straightforward: 'All scholars working on land use/land-cover change grant culture some importance, but most despair of forming any useful generalizations about it' (p. 61), primarily because, it is stated, those aspects of culture which really matter are the hardest to measure, and culture itself is far too local a phenomenon to be subject to any form of generalization.

One of the most highly visible current research initiatives in the human dimensions of global environmental change is integrated assessment (Dowlatabadi and Morgan, 1993; Rotmans and van Asselt, 1996). Its prominence is evident, for instance, in that several of the US National Science Foundation's recently designated Human Dimensions of Global Change Research Centers plan to organize their activities directly around the rubric of integrated assessment. One recent description of this field states:

"The motivation for integrated assessment is the need for policy decisions on how to prevent and/or adapt to climate change, and how to allocate scarce funds for

climate research. In order to address these needs, we need to move beyond isolated studies of the various parts of the problem. Analysis frameworks are needed that incorporate our knowledge about precursors to, processes of, and consequences arising from climate change". (Dowlatabadi, 1995, p. 289)

As suggested in this quote, integrated assessment is in its current phase devoted almost solely to climate change (Cohan, 1996; Dehaan *et al.*, 1994; Easterling III *et al.*, 1993; Hulme *et al.*, 1995; Kenny *et al.*, 1995; Lonergan *et al.*, 1993). And though many of these papers stress the need to include in their models all relevant human processes, there can be no dispute that the models are primarily economic; indeed, one overview of these models categorizes them as either cost-effectiveness, cost-impact, or cost-benefit based (Dowlatabadi, 1995). It should not come as a surprise to discover that culture is scarcely even qualitatively mentioned in descriptions of these models (with the lone exception of some efforts to include a quantifiable grid-group notion of culture; see discussion below). Thus, in important ways so-called 'integrated assessment' models are quite narrow in the kinds of environmental change they consider, and the kinds of human factors they include.

Yet culture is not entirely absent from integrated assessment models. One recent publication has charged exactly the opposite:

"[Integrated assessment] models reproduce implicit assumptions about the cultural and political, in effect extending the assumption that these remain unchanged, or involve only smooth marginal change. It is not that the scientific models and ensuing knowledge are empty of culture and politics, but that they are impregnated with them without even recognizing it, let alone the implications. Existing cultural and institutional structures are by default taken as immanent and natural". (Shackley and Wynne, 1995, p. 124)

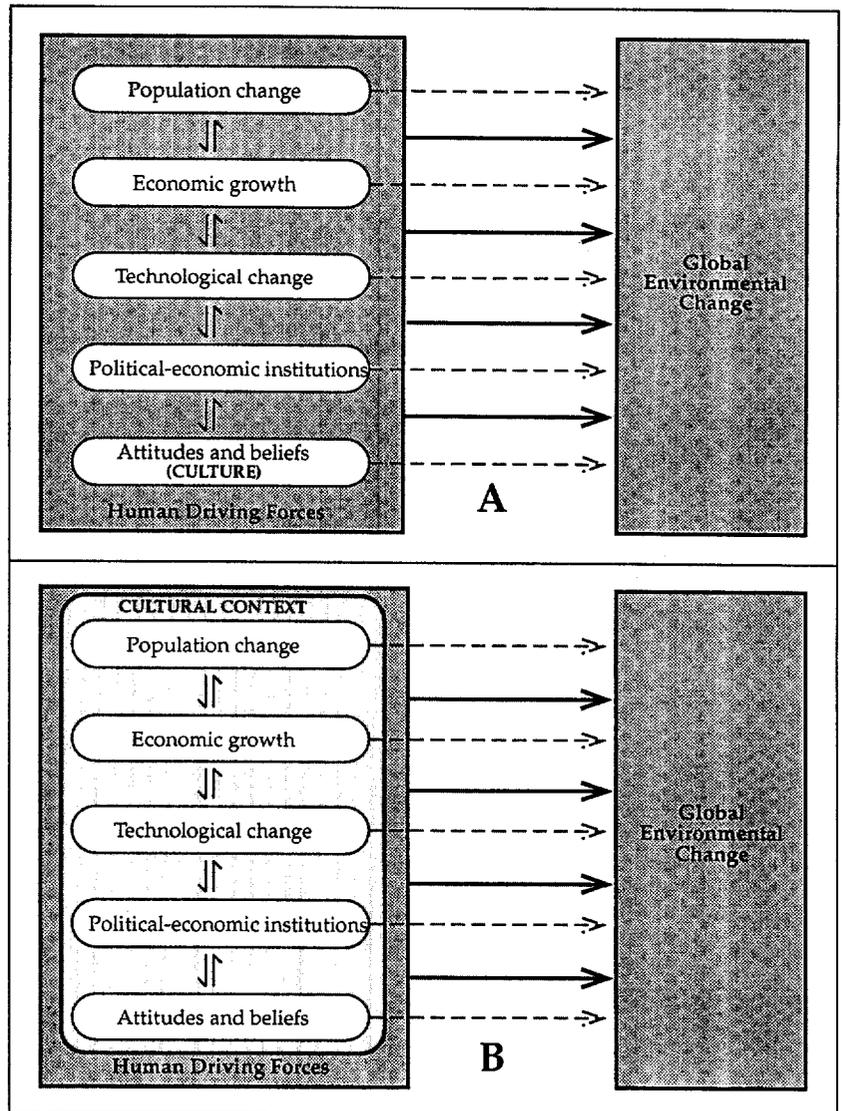
It is likely that, to the extent that ongoing human dimensions research initiatives such as integrated assessment fail to engage explicitly with culture, they unwittingly introduce a great deal of cultural baggage into their modes of analysis.

#### *Some troublesome assumptions*

As suggested in the foregoing research agendas and research initiatives, culture is a vague concept at best in the bulk of human dimensions research. Where mentioned, it is a kind of catch-all context representing the human specificity of the place being studied; yet this context offers no analytical clarity, no basis for saying something about how precisely culture enters into global environmental change. Where not mentioned (and this is common), culture simply disappears from the human dimensions equation altogether, as if it does not matter, or perhaps even exist. In spite of the vagueness surrounding most uses of the term 'culture' in human dimensions research, however, three general trends can be discerned, which will be discussed in turn.

#### *Separability*

Separability assumes that culture can be disentangled from, and analyzed as if it were essentially independent of, other human dimensions of global environmental change. Figure 1a, for instance, presents the five major human driving forces of global environmental change listed in the NRC study. Though this rubric of driving forces is more nuanced than some alternatives (e.g., Kates *et al.*, 1990, pp. 11–12), it nonetheless shares the



**Figure 1.** Human driving forces of global environmental change noted in NRC study, with (a) culture linked primarily to attitudes and beliefs as suggested in text, and (b) all five driving forces involving a significant cultural context. (Other overarching contexts [e.g. political factors] similarly apply to all driving forces, but are omitted here for clarity.) Solid arrows denote net effects of driving forces on global environmental change; dashed arrows indicate possible independent effects.

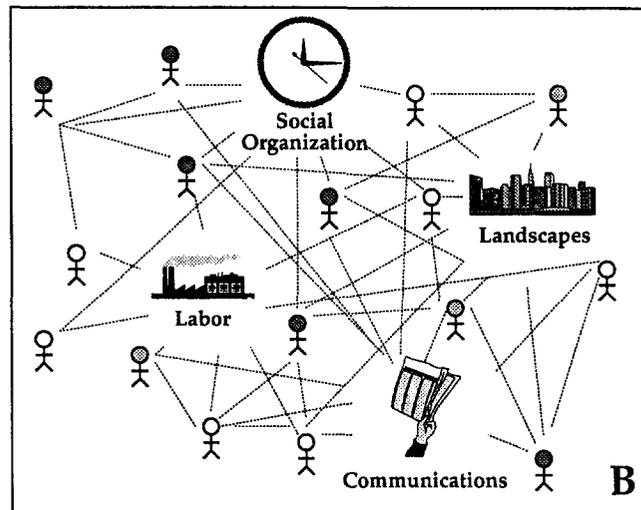
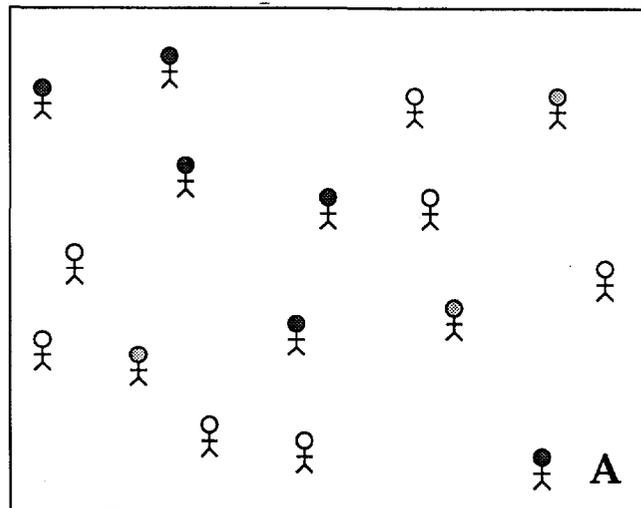
property of compartmentalizing culturally based attitudes and beliefs separate from other driving forces.

Separability leads to several important implications concerning culture. One is that the problem becomes frequently posed whether cultural factors are, independent of other factors, significant in driving environmental change, or whether in a comparative sense they are more important than, for instance, demographic factors. One example is a recent essay on the relationship between culture and land use/land-cover change. The author states, "This paper is a response to [the] question . . . : Does culture have an *independent direct effect* on how people use their land and how they change its cover, and if so, what is the magnitude of that effect?" (Rockwell, 1994, p. 358) This line of thinking leads to a further, disturbing implication: that culture, being separate (and perhaps of relatively little explanatory power compared against other factors) can readily be excised from the equation with little effect. Indeed, the exclusion of culture from many of the accounts noted above follows quite logically from this separability doctrine.

*Methodological individualism*

Methodological individualism is the social science position in which, according to Timothy Lukes, 'Social wholes, or aggregate patterns of behavior, must always be explained, or ultimately explained, in terms of individuals' (Lukes, 1993, p. 277). Lukes notes how debate over methodological individualism has raged in the social sciences for some time, with advocates such as Karl Popper linking it with liberalist notions of freedom in society, and opponents such as Emile Durkheim arguing that no real advance in social science knowledge can be expected without first rejecting it.

In the context of culture, methodological individualism is the working assumption that, at least for the intents and purposes of social science, culture is roughly equivalent to the various attitudes and beliefs of individual persons, as suggested in Figure 2a. This assumption is unabashedly maintained in one recent definition in the context of human dimensions of land use/cover change, where culture consists of 'verbal communication by individuals about their values, attitudes, norms, and knowledge' (Rockwell, 1994, p. 359). The author of this passage defends his definition



**Figure 2.** (a) Culture as the various attitudes and beliefs of individual persons (methodological individualism), and (b) a cultural network of meaning linking these persons to each other and to representative supra-individual elements associated with cultural production and reproduction.

as one that is relatively specific and leads to direct methodological implementation. Methodological individualism is indeed methodologically driven, in that culture *qua* culture is much more difficult to measure than its effects as evidenced in the beliefs of individual humans. Yet this methodological impulse leads to an effective metaphysical position that, above and beyond individual meanings and their patterns among individuals, larger systems of meaning do not exist. Methodological individualism is thus closely tied to the metaphysical precept of nominalism: that, in contrast to particulars, large concepts like culture are merely names, and possess no reality independent of language.

It is not surprising that methodological individualism and nominalism, its metaphysical counterpart, have strongly affected the ways in which culture is operationalized in human dimensions research. Indeed, these are fundamental, though largely unwritten, tenets of the widespread social science paradigm of positivism (Keat and Urry, 1982). In this light, culture *qua* culture disappears as a potential object of scientific analysis precisely because it has no status above and beyond the lay sense of the term: people will still use the word culture to make sense of reality, but their usage of the term does not, following nominalism, demonstrate that culture really exists.

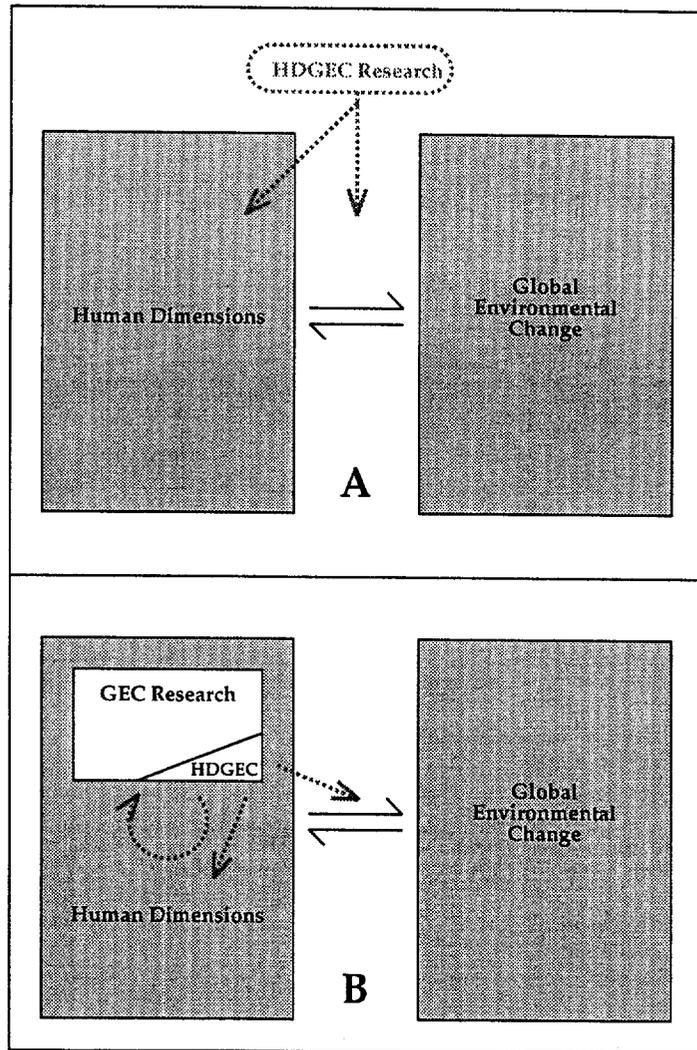
#### *Externality*

Externality is a slightly different, but even more fundamental, assumption about culture than the previous two. The notion of externality is that human dimensions research does not itself embody important cultural aspects worthy of analysis; i.e. it is external to the object of analysis. There are, of course, excellent exceptions to this rule in the human dimensions literature (e.g., Buttel *et al.*, 1990; Wynne, 1994; Shackley and Wynne, 1995), but the bulk of the human dimensions research efforts summarized above proceed from the assumption that the researcher stands apart from the object of research, as suggested in Figure 3a. Thus, when culturally based attitudes, beliefs, and so forth are mentioned as important filters in the ways people perceive and respond to global environmental change, there is no concession that the cultural filters of the analyst or the analyst's scientific tradition may play any role. The human dimensions researcher stands, as it were, on an Archimedean point, from which the world can be observed.

Similar to the assumption of methodological individualism, the assumption of externality follows logically from prevailing philosophies of social science which place high value on objectivity or detachment of knowing subject from the object of inquiry. In so doing, however, these approaches run the serious risk of involving a good deal of their own context into the analysis, as suggested above in the case of integrated assessment. The irony of the externality assumption is thus that, in implicitly *removing* global environmental change research from the object of human dimensions analysis, the norms and values that define this research effort may be unwittingly *inserted* into the heart of the inquiry.

#### *The grid-group model: A step in the right direction?*

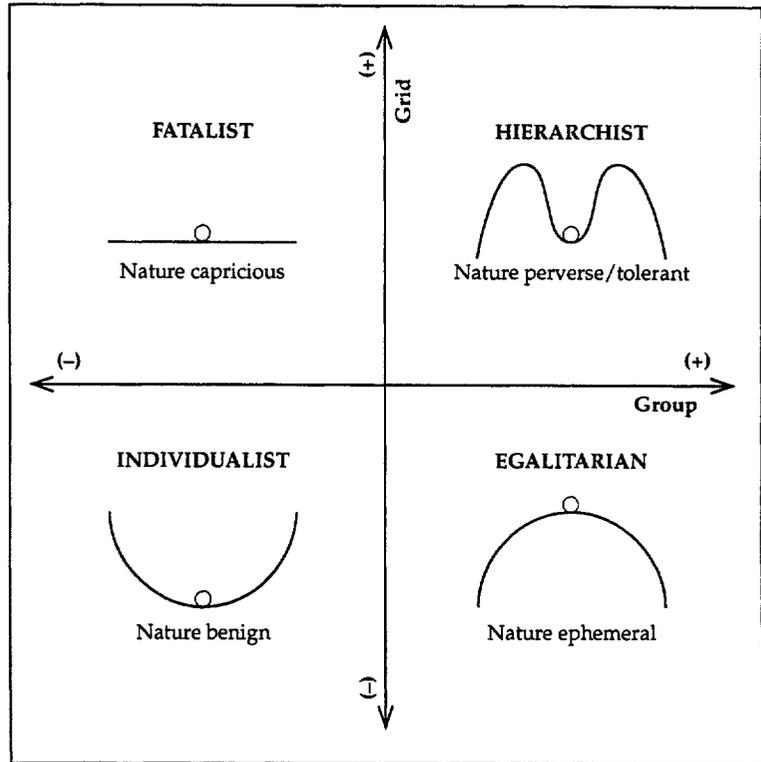
Though the above review and critique of culture captures a good deal of its usage in human dimensions research, one approach, the 'grid-group' model of culture, stands out as an exception, and deserves brief examination in its own right. The grid-group model is traceable back to the work of



**Figure 3.** Human dimensions research as (a) external to the objects of inquiry (noted by dashed arrows), and (b) included as an object of inquiry in the context of global environmental change research.

anthropologist Mary Douglas (1982), and has recently been extended to address culturally based ideas of nature and nature management by Schwartz and Thompson (Schwartz and Thompson, 1990; Thompson *et al.*, 1990). This approach defines four 'myths of nature', each occupying one quadrant of a two-dimensional social schema (Figure 4). The axes of this schema define the extent to which individuals feel (a) an affinity or allegiance to society, and (b) a sense of control or regulation of their actions by society. The first dimension is called 'group'; the second, 'grid'. The individualist perspective, for instance, arises from a low social affinity and relatively little sense that one's actions are regulated by society. Nature, to the individualist, is benign and forgiving, and thus requires little regard. Different cultural predispositions, and their related ideas of nature, define the other three quadrants; the end result is a sense of how culture can result in a broad spectrum of attitudes toward nature and nature management.

The prominence of the grid-group theoretical approach to culture in environmental change research is impressive (Cantor and Rayner, 1994; Harrison and Burgess, 1994; Meyer and Turner, 1995; Rayner, 1991; Rayner *et al.*, 1994; van Asselt and Rotmans, 1996). Indeed, it has enjoyed



**Figure 4.** The grid-group typology of cultural perspectives on nature.

almost an orthodoxy of sorts in human dimensions research, perhaps due to its relative clarity and ease of linking with quantitative models, which has made it useful in integrated assessment analyses (Jannsen and Rotmans, 1995; van Asselt and Rotmans, 1996).

The grid-group model does not fall victim to the problematic assumptions noted above in the same way as do less theorized notions of culture deployed in human dimensions research. One example is methodological individualism. As Steven Rayner, a major proponent of the grid-group theory, has argued in the context of global environmental agreements:

“Much of human thought is both social and public. ... We do not think merely with a private metaphysical mind, but with words, pictures, gestures, actions, and both natural and manufactured objects. Culture consists of the framework we use to impose some sort of order and coherence on the stream of events”. (Rayner, 1991, p. 84)

Yet, in spite of its relatively high degree of theorization and its increasing usage in human dimensions research (arguably a good thing in its own right), grid-group applications in human dimensions research deserve more careful scrutiny. While space precludes a fuller critical analysis of the relevance of the grid-group theory of culture to studies of human – environment interaction, three salient limitations will be discussed briefly here. The first is its reductionistic tendency to regard cultural dimensions of environmental change as a function of specific social dimensions, namely perceived social affinity (group) and control (grid). The problem with this reductionism is twofold: not only are these social dimensions themselves subject to question in terms of their ontological assumptions about society and how it works, but a whole host of other potential contributing factors to the culture of a specific group of people – its mode of political and

economic organization, material patterns of human – environment interaction, religious and linguistic heritage, and so forth – are largely ignored.

The second limitation with the grid-group theory concerns the relatively contingent relationship between the grid-group typology and the four myths of nature. Why, for instance, does a high group/high grid sensibility – the ‘hierarchical’ – necessarily involve a myth of nature as tolerant within limits, whereas a high group/low grid sensibility – the ‘egalitarian’ – necessarily view nature as exceedingly sensitive to human perturbations? These connections could certainly be otherwise, as some reflection will immediately suggest. The grid-group theory makes a little more sense when actual examples are noted – in this case, the scientific-managerial community for the high group/high grid quadrant, and the more ecocentric or deep ecological environmentalist community for the high group/low grid quadrant – as these example groups do display certain of the grid-group inclinations and myths of nature noted in the diagram. But the fit is more a contingent one, associated with the arguably complex ideological predispositions of these groups, than some direct relationship between grid-group sensibility and nature myth.

The third limitation – what some may consider an advantage! – is that culture becomes static, determinate, and consistent. Although sensitive readings of the grid-group theory by those who have used it do include acknowledgment that it grossly simplifies a quite dynamic cultural reality (van Asselt and Rotmans, 1996, p. 130), its implementation is rather mechanical and predictable: for instance, hierarchists have a predictably management-oriented style toward balancing economic growth with environmental quality, whereas individualists, in direct contrast to egalitarians, desire unrestricted economic growth, all of which can be rather straightforwardly plugged into global environmental change policy models (Janssen and Rotmans, 1995). One is left wondering not only what gains were made by using grid-group theory as a point of departure to a rather hackneyed conceptualization of cultural attitudes, but whether these gains, if any, are offset by the furtherance of a model of culture as a rather stable and consistently organized mechanism. In light of this and the above limitations, grid-group theory does not stand out as an adequate answer to the charges raised earlier concerning the ways in which culture is currently conceptualized in human dimensions research (for a similar assessment, see Shackley and Wynne [1995, p. 123]; accordingly, there remains the need for retheorization, to which I now turn.

## **Retheorizing culture**

### *The strong argument*

The concept of culture implied in a good deal of human dimensions research is what could be called a ‘weak’ version: though it does somehow affect global environmental change, it is unclear precisely what role culture plays, and at any rate its supposed idiographic, nonquantifiable tendencies marginalize it, leaving only the elicited attitudes and beliefs of groups of individual persons as a stand-in.

I intend to replace this overall conception of culture with a strong version, which explicitly ties cultural processes into the full fabric of human existence. I will begin by reframing the problematic of environmental change, then discuss how culture – more properly, the cultural – is best conceived as the pervasive dimension of meaning in social reality.

*The meaning of environmental change*

What is environmental change? Most accounts (especially popular ones) imply that environmental change consists of a set of biophysical facts about human impacts on the earth, some of which are plainly evident (e.g. natural resource degradation), and others of which are partly clouded in uncertainty (e.g. global warming). This account is, however, naive in that it downplays the active role of humans in making sense of the world around them. If we have learned anything at all during this century from the philosophy of science and anthropology, it is that knowledge, both 'scientific' and 'lay', arises not so much out of direct and passive observation of the facts of the world (a position generally known as empiricism), but rather out of active interplay between the knowing subject and the object of knowledge – a constructivist, though nonrelativist, position perhaps most carefully advanced by contemporary realists (Bhaskar, 1975; Keat and Urry, 1982; Sayer, 1992; Sayers, 1985).

Implications for the study of environmental change are profound. Rather than conceiving of environmental change as presenting itself more or less transparently to people as a function of biophysical complexity alone, the phenomenon becomes a much more complex interrelationship between biophysical and human processes, of which the process of signification stands out as a particularly critical human dimension of environmental change.

This perspective is by no means absent in the literature, yet to consider it prominent would be an overstatement. For example, the monumental volume on environmental change *The Earth as Transformed by Human Action (ET)* includes an historical essay by David Lowenthal on how people have made sense of environmental transformation primarily over the last several centuries, and a theoretical essay by Robert Sack that explores the diffuse role of meaning in anthropogenic environmental change, as well as representative theories that prioritize meaning in their explanation of why humans have so radically transformed the earth (Lowenthal, 1990; Sack, 1990). Yet these essays almost disappear amidst the chronicles of environmental change that occupy the bulk of ET's 700 plus pages, a descriptivist tendency for which the volume has been criticized (Rayner, 1995). Though the editors of ET have recently argued that their emphasis on description was justified in light of the need for a stocktaking prior to further analysis (Turner *et al.*, 1995), there are clearly many stones left unturned in the literature on the meaning of environmental change.

*The nature of culture*

I propose that we think of this fundamental human dimension of global environmental change as its cultural dimension, where 'culture' now becomes understood not so much in some *descriptive* sense as what people in a particular locale eat, wear, and believe, as in a more properly *symbolic* sense as a process of shared meaning, a means of making sense of reality.

The concept of culture has been critical, though variably-understood, in social science in the 20th century (Thompson, 1990) and certainly in the post-World War II period (Münch and Smelser, 1992; Ortner, 1984; Payne, 1996). In the discipline of geography, it has prompted a series of discussions largely focusing on the relationship between meaning and landscape (Cosgrove, 1994a; Mikesell, 1978; Mitchell, 1995; Price and Lewis, 1993). In more recent usages, geographers have emphasized the dynamic, socially negotiated character of cultural meanings (Cosgrove, 1984;

Duncan, 1990; Jackson, 1989) while generally holding to the post-artifactual, symbolic sense of culture most often traced back to Clifford Geertz (Geertz, 1973). Geographers have also explored implications of this refined concept of culture for environmental change research (e.g., Burgess, 1990).

One particular theoretical and methodological danger inherent even in a reformulated concept of culture, spelled out most recently by Don Mitchell (Mitchell, 1995, 1996) is that 'culture' can become reified, i.e. ontologically conceived not as an analytical concept but as a real thing, a realm of meaning that somehow exists independent of, but nonetheless influences and hence explains, material reality. These tendencies, if unchecked, lead to the error of idealism, which has long been criticized by social theorists (Bhaskar, 1983).

One way to steer clear of idealism is to conceive of culture not as a noun but as an adjective, a quality of social processes versus an independent social process in its own right. Whereas the independent reality of *culture* is indeed not only dubious but misleading due to problems associated with reification, the reality and pervasiveness of *cultural* processes – processes of meaning produced and consumed – are undeniable. The implication is not just semantic, and indeed does not necessitate elimination of the word 'culture' as much as a reframed emphasis on the role of meaning in all salient human processes related to global environmental change.

#### *Implications for research*

##### *Three assumptions revisited*

The strong version of culture presented above not only stands in stark contrast to some tendencies inherent in human dimensions research, but also lends a particular impetus to the kinds of research questions that follow. These elements will be discussed with respect to the three assumptions mentioned above.

In contrast to the *separability* notion of culture as one among many relatively independent human dimensions of global environmental change, the strong version asserts that cultural processes of meaning are implicated in all relevant human practices (Figure 1b). Though separating human dimensions into discrete categories perhaps only makes analytical sense in all cases, it is far better to ask whether, for instance, high rates of demographic growth have been experienced in places undergoing high rates of environmental transformation than to ask whether culture has contributed in any significant way.

Cultural meanings, I am unabashedly claiming, are everywhere people are to be found. Culture always plays a role in informing human practices connected with global environmental change. The operative question for research is not whether culture is important enough to be included in some model, nor how important culture is relative to other dimensions, but rather: what kinds of shared meanings are connected with the full range of human practices associated with global environmental change? how are they produced and consumed, maintained and transformed? Culture itself is a dimension of all other human dimensions of global change; thus research must be done to explicate the myriad cultural dimensions associated with relevant human practices.

In contrast to the assumption of *methodological individualism*, the strong version of culture asserts that meanings are not wholly private, nor are their patterns among groups of individuals entirely coincidental, but rather that individual meanings arise in a context of more-or-less shared

meanings. Culture, in other words, is actively appropriated by reflexive human beings, but it is primarily a shared phenomenon, not at all reducible to its expression in the consciousness of particular individual human beings (and certainly not reducible to how they respond on a survey form!). Indeed, culture is evidenced not only in the considered attitudes and beliefs of individuals, but perhaps even more primarily in their behavior (what is typically called practical consciousness, as opposed to discursive consciousness; see Giddens, 1984).

Culture, therefore, is evidenced in far more than attitude surveys, though these too are very important. As suggested in Figure 2b, individuals draw from and contribute to a number of cultural networks in their personal and professional lives; the networks themselves are not directly observable, but the institutions and other supra-individual features bound up in these networks can be analyzed in terms of their cultural role. Some, such as religion, are traditional areas of cultural inquiry; others, such as popular media, have been more recently emphasized by researchers (e.g., Burgess and Gold, 1985). All join to form, visually and practically, the metaphor of culture espoused by Clifford Geertz:

“Believing, with Max Weber, that man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning”. (Geertz, 1973, p. 5)

An additional note of caution against idealism is in order at this point. To reject methodological individualism is not to embrace the superorganic notion of culture as some organized realm of ideas that floats above the consciousness of individual persons (Duncan, 1980). Though culture cannot be reduced to its traces in individual consciousness, it does not lie ‘above’, ‘beyond’, or ‘underneath’ individuals. Indeed, the research implications of this anti-individualistic thrust in the strong conception of culture do not involve curtailing research on the important psychological properties of meanings. Scholars such as Paul Stern are explicating a number of important psychological properties of environmental attitudes and beliefs (Stern and Dietz, 1994; Stern *et al.*, 1995). Rather, the very important surveys currently being deployed through the ISSC International Human Dimensions Programme’s Attitudes, Perceptions, Behavior, and Knowledge priority activity, which include the baseline Global Omnibus Environmental Survey (GOES) and a more detailed study in the formation of opinion called Perception and Assessment of Global Environmental Change (PAGEC), can be inserted into a cultural reference by means of detailed studies at various spatial scales, in order to establish the relationship between individual and shared systems of meaning related to global environmental change.

Finally, in contrast to the assumption that human dimensions research is *external* to the object of inquiry, the strong theory of culture implies that there is a very important cultural element that permeates human dimensions research, which itself ought to receive due attention. As suggested in Figure 3b, then, the whole global environmental change research effort ought to be reinserted into the object of inquiry, not to imply in solipsistic fashion that there is no other legitimate object of inquiry, but to remember the positionality of human dimensions research.

The implications of this situated approach for research are apparent. The first task is for human dimensions research to adopt a more self-critical position – to understand its own cultural baggage, so to speak. The

human dimensions research effort is a (rather small) subset of global environmental change research. What meanings have informed this massive research effort? And in what ways is human dimensions research ideologically derivative of the larger physical science effort, and with what kinds of implications? As suggested at the outset of this paper, the story of human dimensions research has been told on multiple occasions, yet a critical analysis of the particular perspective adopted in human dimensions research has yet to be advanced.

This critical analysis of the context of human dimensions research could adopt many themes. As one example, Steve Rayner has noted the preponderance – especially strong in the US – of ‘reductionist’ views of human dimensions research, in which ‘the natural science system shapes the human response’ (Rayner, 1992, p. 26). According to this view, human dimensions research has had its agenda preconfigured by physical science inquiry into global environmental change. This charge is difficult to dispute. Take, for instance, the preponderance of interest expressed in early human dimensions research – and still persistent today in forms such as integrated assessment – regarding climate change. Though research into the impacts of climate change soon matured into areas such as differential vulnerability (Madduma Bandara, 1989; Dow, 1992; Gallopin *et al.*, 1989; Liverman, 1990; Patz and Balbus, 1996) nonetheless the problematic set for human dimensions research was clearly that which was of interest to the physical science community.

And there is little dispute that climate change research clearly dominates much global environmental change research, especially in the United States. The National Aeronautics and Space Administration (NASA) has been a leading player in developing interagency research on global change in the United States (Fleagle, 1994, pp. 121ff.) with roughly two-thirds of recent US Global Change Research Program (USGCRP) funding coming from NASA (Subcommittee on Global Change Research, 1995, p. 128). And it comes right back: space-based data gathering and data management account for fully 65% of the 1996 USGCRP budget. Only seven percent of the recent USGCRP budget has been devoted to research areas with any human dimensions, and three-quarters of this is devoted to ‘evaluation of consequences’, which includes biophysical as well as socio-economic impacts of altered climate (p. 129). Human dimensions research is clearly a relatively minor player in the global environmental change research effort; perhaps this is in large part why its problematic is so often derived from the questions entertained in physical science research.

If self-criticality were enhanced, human dimensions research would then be in a better position to look outward to its object of analysis while remaining mindful of the context it brings into the analysis. This may necessitate some careful rethinking of the theories and tools used in human dimensions research, however. As suggested throughout this paper, for instance, the assumptions about culture bound up in most human dimensions efforts clearly influence the shape these efforts take, and thus the conclusions they eventually draw.

*Method: extensive and intensive needs*

The above discussion must necessarily lead to some treatment of epistemology and methodology. If culture is as pervasive as I (and others) allege, then how is it to be analyzed? Are existing methods useless?

First, an even larger question must be mentioned: how can one analyze culture in global environmental change, if one always resides within some

cultural context? I am uncomfortable with taking this position to its relativist extreme. A possible epistemological position for human dimensions research could be called *interpretive realism*, a realist account (see above) that acknowledges the cultural embeddedness of reality without collapsing reality into our ideas of it, and at the same time emphasizes the need for interpretive understanding of why different conceptions of reality (in our case, global environmental change and its human dimensions) exist. Interpretive realism would represent an effort to steer between the avoidance of meaning found in much positivistic environmental change research (Wynne, 1994), and the thoroughly social constructivist approach to all meaning – including scientific meanings – found in so-called ‘post-modernist’ research (Blaikie, 1996).

Following from an interpretive realist viewpoint, both quantitative and qualitative approaches are needed. Both, when applied correctly, have yielded important rewards in explicating environmental meanings. For example, Stern and other researchers have determined from quantitative methods that the ‘biospheric’ values orientation proposed by environmentalists is not yet evident among the general public, nor sufficiently distinguishable from a more homocentric ‘social-altruistic’ orientation (Ster and Dietz, 1994; Stern *et al.*, 1995). As an example of qualitative research, Harrison and Burgess have examined the perspectives of developers, environmentalists, and the lay public on the proposed development of a marsh in lowland Britain, detecting subtleties in these perspectives that quantitative research would arguably have missed entirely (Harrison and Burgess, 1994; see also Burgess *et al.*, 1998).

Quantitative and qualitative approaches can serve complementary roles as what has been called extensive and intensive research (Sayer, 1992, p. 241ff.). Extensive research aims to discover properties and patterns in a population, whereas intensive research focuses on developing a deeper understanding in particular case studies. Both are legitimate and necessary components of an interpretive realist approach to research.

### **Putting the pieces together: Modernity, meaning, and global environmental change**

This paper has focused primarily on correcting some notions I consider to be mistaken and harmful with respect to how culture has been conceived in human dimensions of global environmental change research. To the extent that social science efforts in this vein continue to take their methodological cue from the natural sciences – a position known as naturalism (Bhaskar, 1979) – there will be only limited inroads made into the very important cultural processes at work. Culture cannot be conceived and researched in the same way that, for instance, climate can; both are complex, but developing knowledge on culture will necessitate taking a different path than developing knowledge on climate change. Similarly, to the extent that social science efforts view their objective as instrumental versus interpretive, culture will never matter much in human dimensions efforts, as it generally appears to be far less amenable to policy tinkering than, say, the economy (I am grateful to Steve Rayner [personal communication, 16 December 1996] for this observation). Thus, rethinking culture forces some rethinking of the human dimensions research effort itself – no small matter indeed.

Putting culture back into human dimensions research should not be viewed, however, as leading to a lesser, more confusing end. In addition to gaining knowledge on what arguably is the most fundamental human dimension of global environmental change, there are a number of positive contributions human dimensions research can make to the social science community by taking culture more seriously. Perhaps one of the most potentially significant areas concerns the range of spatial scales encompassed by global environmental change research, and the resultant span of culture that can be included in analysis. Culture has primarily been explicated via the anthropological method of intensive case studies, which has yielded valuable insights but has not been able to consider the possibility that cultural systems of meaning exist at all spatial scales from local to global.

Indeed, far from being mere idiographic noise or some formless background to human life, culture can take on a whole new light in the context of global environmental change, as now the potential spatial scale can be vast. More questions emerge: is there global culture (Featherstone, 1990; Robertson, 1992), and if so, how is it related to global environmental change? Is there global cultural change? (Johnston *et al.*, 1995). If culture really matters, should we reconceive of the entire biosphere as a noosphere, a sphere of reason, of meaningful human activity directed toward its purposive development? (Moiseev, 1989). Or on the other hand, is there a threat posed by globalization to culture in its diverse forms, as unwittingly exemplified in earth system science and global environmental change research (Cosgrove, 1994b) and global environmental management programs such as those adopted at the 1992 Rio Earth Summit (Sachs, 1993)?

Globalization could not have occurred without the set of linked social, political, economic, and technological processes that have emerged over the last several centuries and are generally woven together under the rubric of modernity (Berman, 1982; Entrikin, 1991; Giddens, 1990; Horkheimer and Adorno, 1972; Pred and Watts, 1992). One crucial object of human dimensions inquiry thus ought to be the differentiated condition and experience of modernity. Humans have transformed the earth for thousands of years, but never to the extent as has occurred over the last several centuries. Modernity is full of cultural contradictions – the professed mastery of nature juxtaposed against the burgeoning environmental movement, for example (Gare, 1995). How do these contradictions influence and respond to global environmental change, and what future (post-modern?) implications exist?

Modernity has conferred a set of meanings about global environmental change which can only be grasped by attending to the three critical features of the retheorized notion of culture noted above. Only by means of thinking of culture as a pervasive element present in all features of modern life, by looking beyond individuals to their relationships with each other and with meanings sedimented in institutions and other perennial forms, and by examining carefully the pivotal role of science in the modern era, can the cultural traces of modernity be fully understood.

My hope is that human dimensions research will seize the opportunity to make a genuine theoretical and practical contribution in topics such as global culture and the condition of modernity. These are not the kinds of topics which are typically listed as germane to human dimensions research, but they are among some of the most profound intellectual areas of interest in the social sciences today. Given its interdisciplinary makeup

and its broad-ranging spatial scope, human dimensions research stands poised to explicate the meaning of global environmental change – its cultural basis and implications – and in so doing contribute to some larger affiliated problems in social science. Such is the potential reach of human dimensions research, a reach that will be met by its grasp provided sufficient attention is paid to its theoretical basis.

## References

- Arizpe, L. (1991) The global cube. *International Social Science Journal* **43**(4), 599–608.
- Berman, M. (1982) *All That is Solid Melts into Air: The Experience of Modernity*. Simon and Schuster, New York.
- Bhaskar, R. (1975) *A Realist Theory of Science*. Leeds Books, Leeds.
- Bhaskar, R. (1979) *The Possibility of Naturalism*. Harvester Books, Hassocks.
- Bhaskar, R. (1983) Idealism. In *A Dictionary of Marxist thought*, ed. T. Bottomore, p. 218. Harvard University Press, Cambridge, MA.
- Blaikie, P. M. (1996) Post-modernism and global environmental change. *Global Environmental Change: Human and Policy Dimensions* **6**(2), 81–85.
- Burgess, J. and Gold J. R. (ed.) (1985) *Geography, the Media and Popular Culture*. Croom Helm, London.
- Burgess, J. (1990) The production and consumption of environmental meanings in the mass media: A research agenda for the 1990s. *Transactions of the Institute of British Geographers* **15**, 139–161.
- Burgess, J., Limb, M. and Harrison, C. M. (1998) Exploring environmental values through the medium of small groups: 1. Theory and practice, 2. Illustrations of a group at work. *Environment and Planning A*, **20**, 309–326, 457–476.
- Burton, I. and Timmerman, P. (1989) Human dimensions of global change – a review of responsibilities and opportunities. *International Social Science Journal* **41**(3), 297–313.
- Buttel, F. H., Hawkins, A. P. and Power, A. G. (1990) From limits to growth to global change: constraints and contradictions in the evolution of environmental science and ideology. *Global Environmental Change* **1**(1), 57–66.
- Buttel, F. and Taylor, P. (1994) Environmental sociology and global environmental change. In *Social Theory and the Global Environment*, eds. M. Redclift and T. Benton, Routledge, London, pp. 228–255.
- Cantor, R. and Rayner, S. (1994) Changing perceptions of vulnerability. In *Industrial Ecology and Global Change*, eds. R. H. Socolow, C. Andrews, F. Berkhout, and V. Thomas pp. 69–83. Cambridge University Press, Cambridge.
- Clark, W. C. (1988) The human dimensions of global environmental change. In *Toward an Understanding of Global Change: Initial Priorities for U.S. Contributions to the International Geosphere-Biosphere Programme* Committee on Global Change, pp. 134–200. ed. National Academy Press, Washington, DC.
- Clark, W. C. (1989) The human ecology of global change. *International Social Science Journal* **41**(3), 315–345.
- Cohen, S. J. (1996) Integrated regional assessment of global climatic change – Lessons from the Mackenzie Basin Impact Study (MBIS). *Global and Planetary Change* **11**(4), 179–185.
- Cosgrove, D. (1994a) Culture. In *The Dictionary of Human Geography*, eds. R. J. Johnston, D. Gregory and D. M. Smith, pp. 116–117. Blackwell Publishers, Oxford.
- Cosgrove, D. (1994b) Contested global visions: One-World, Whole-Earth, and the Apollo space photographs. *Annals of the Association of American Geographers* **84**(2), 270–294.
- Cosgrove, D. E. (1984) *Social Formation and Symbolic Landscape*. Croom Helm, London.

- Dehaan, B. J., Jonas, M., Klepper, O., Krabec, J., Krol, M. S. and Olenzdrzynski, K. (1994) An atmosphere-ocean model for integrated assessment of global change. *Water Air and Soil Pollution* 76(1–2), 283–318.
- Dickens, P. (1992) *Society and Nature: Towards a Green Social Theory*. Temple University Press, Philadelphia.
- Douglas, M. (ed.) (1982) *Essays in the Sociology of Perception*. Routledge and Kegan Paul, London.
- Dow, K. (1992) Exploring differences in our common future(s) – the meaning of vulnerability to global environmental change. *Geoforum* 23(3), 417–436.
- Dowlatabadi, H. and Granger Morgan, M. (1993) Integrated assessment of climate change. *Science* 259(5103), 1813–1814.
- Dowlatabadi, H. (1995) Integrated assessment models of climate change: an incomplete overview. *Energy Policy* 23(4–5), 289–296.
- Duncan, J. (1980) The superorganic in American cultural geography. *Annals of the Association of American Geographers* 70, 181–198.
- Duncan, J. S. (1990) *The City as Text: The Politics of Landscape Interpretation in the Kand yan kingdom*. Cambridge University Press, Cambridge.
- Easterling, III, W. E., Crosson, P. R., Rosenberg, N. J., McKenney, M. S., Katz, L. A. and Lemon, K. M. Agricultural impacts of and responses to climate change in the Missouri–Iowa–Nebraska–Kansas (MINK) region. *Climatic Change* 24(1–2), 23–61.
- Entrikin, N. J. (1991) *The Betweenness of Place: Towards a Geography of Modernity*. The John Hopkins University Press, Baltimore.
- Featherstone, M. (ed.) (1992) *Global Culture: Nationalism, Globalization and Modernity*. Sage, London.
- Fleagle, R. C. (1994) *Global Environmental Change: Interactions of Science, Policy, and Politics in the United States*. Praeger Publishers, Westport, CT.
- Gallopin, G. C., Gutman, P. and Maletta, H. (1989) Global impoverishment, sustainable development and the environment: a conceptual approach. *International Social Science Journal* 41(3), 375–397.
- Gare, A. E. (1995) *Postmodernism and the Environmental Crisis*, Routledge, London.
- Geertz, C. (1973) *The Interpretation of Cultures*. Basic Books, New York.
- Giddens, A. (1984) *The Constitution of Society: Outline of the Theory of Structuration*. University of California Press, Berkeley.
- Giddens, A. (1990) *The Consequences of Modernity*. Stanford University Press, Stanford.
- Hall, J. A. (1993) Culture. In *The Blackwell Dictionary of Twentieth-century Social Thought*, eds. W. Outhwaite and T. Bottomore, pp. 129–132. Blackwell, Oxford.
- Harrison, C. M. and Burgess, J. (1994) Social constructions of nature: A case study of conflicts on the development of Rainham Marshes. *Transactions of the Institute of British Geographers* 19(3), 291–310
- Jackson, P. (1989) *Maps of Meaning: An Introduction to Cultural Geography*. Routledge, London.
- Horkheimer, M. and Adorno, T. W. (1972) *The Dialogue of Environment*. Herder and Herder, New York.
- Hulme, M., Raper, S. C. B. and Wigley, T. M. L. (1995) An integrated framework to address climate change (ESCAPE) and further developments of the Global and regional climate modules (MAGICC). *Energy Policy* 23(4–5), 347–355.
- Jacobson, H. K. and Price, M. F. (1991) *A Framework for Research on the Human Dimensions of Global Environmental Change*. ISSC/UNESCO, ISSC Standing Committee on the Human Dimensions of Global Change, Paris.
- Janssen, M. and Rotmans, J. (1995) Allocation of fossil CO<sub>2</sub> emission rights quantifying cultural perspectives. *Ecological Economics* 13(1), 65–79.
- Johnston, R. J. Taylor, P. J. and Watts, M. J. (eds.) (1995) *Geographies of Global Change: Remapping the World in the Late Twentieth Century*. Blackwell, Oxford.
- Kates, R. W., Turner, II, B. L. and Clark, W. C. (1990) The great transformation. In *The Earth as Transformed by Human Action: Global and Regional Changes in the*

- Biosphere over the Past 300 years*, eds. B. L. Turner, II, W. C. Clark, R. W. Kates, J. F. Richards, J. T. Mathews, and W. B. Meyer, pp. 1–17. Cambridge University Press, Cambridge.
- Keat, R. and Urry, J. (1982) *Social Theory as Science*. Routledge and Kegan Paul, London.
- Kenny, G. J., Warrick, R. A., Mitchell, N. D., Mullan, A. B. and Salinger, M. J. (1995) CLIMFACTS – an integrated model for assessment of the effects of climate change on the New Zealand environment. *Journal of Biogeography* **22**(4–5), 883–895.
- Kroeber, A. L. and Kluckhohn, C. (1952) *Culture: A Critical Review of Concepts and Definitions*. Peabody Museum, Cambridge, MA.
- Liverman, D. M. (1990) Vulnerability to global environmental change. In *Understanding Global Environmental Change: The Contributions of Risk Analysis and Management*, eds., R. E. Kasperson, K. Dow, D. Golding and J. X. Kasperson, pp. 27–39, 41–44. Earth Transformed Program, Clark University, Worcester, MA.
- Lonergan, S., Difrancesco, R. and Woo, M-K. (1993) Climate change and transportation in Northern Canada: an integrated impact assessment. *Climatic Change* **24**(4), 331–50.
- Lowenthal, D. (1990) Awareness of human impacts: Changing attitudes and emphases. In *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 years*, eds. B. L. Turner, II, W. C. Clark, R. W. Kates, J. F. Richards, J. T. Mathews and W. B. Meyer, pp. 121–135. Cambridge University Press, Cambridge.
- Lukes, S. (1993) Individualism. In *The Blackwell Dictionary of Twentieth-century Social Thought*, eds. W. Outhwaite and T. Bottomore, pp. 277–278. Blackwell Publishers, Oxford.
- MacNaghten, P. and Urry, J. (1995) Towards a sociology of nature. *Sociology* **29**(2), 203–220.
- Madduma Bandara, C. M. (1989) Environmental awareness among the most vulnerable communities in developing countries. *International Social Science Journal* **41**(3), 441–448.
- McNeill, J., Alves, D., Arizpe, L., Bykova, O., Galvin, K., Kelmelis, J., Migot-Adholla, S., Morrisette, P., Moss, R., Richards, J., Riebsame, W., Sadowski, S., Sanderson, S., Skole, D., Tarr, J., Williams, M., Yadav, S. and Young, S. (1994) Toward a typology and regionalization of land-cover and land-use change: Report of working group B. In *Changes in Land Use and Land Cover: A Global Perspective*. eds. W. B. Meyer and B. L. Turner, II, pp. 55–72. Cambridge University Press, Cambridge.
- Merchant, C. (1980) *The Death of Nature: Women, ecology, and the scientific revolution*. Harper and Row, San Francisco.
- Meyer, W. B. and Turner, II, B. L. (1995) The earth transformed: Trends, trajectories, and patterns. In *Geographies of Global Change: Remapping the World in the Late Twentieth Century*, eds. R. J. Johnston, P. J. Taylor and M. J. Watts, pp. 302–317. Blackwell Publishers, Oxford.
- Mikesell, M. (1978) Tradition and innovation in cultural geography. *Annals of the Association of American Geographers* **68**(1), 1–16.
- Miller, R. B. (1991) Social science and the challenge of global environmental change. *International Social Science Journal* **43**(1), 609–618.
- Miller, R. B. and Jacobson, H. K. (1992) Research on the human components of global change: Next steps. *Global Environmental Change* **2**(4), 170–182.
- Mitchell, D. (1995) There's no such thing as culture: Towards a reconceptualization of the idea of culture in geography. *Transactions of the Institute of British Geography* **20**(1), 102–116.
- Mitchell, D. (1996) Explanation in cultural geography: A reply to Cosgrove, Jackson and the Duncans. *Transactions of the Institute of British Geography* **21**(4), 580–582.
- Moiseev, N. N. (1989) The study of the noosphere – Contemporary humanism. *International Social Science Journal* **122**, 595–606.

- Münch, R. and Smelser, N. J. (ed.) (1992) *Theory of Culture*. University of California Press, Berkeley.
- Murphy, R. (1994) *Rationality and Nature: A Sociological Inquiry into a Changing Relationship*. Westview Press, Boulder.
- Ortner, S. B. (1984) Theory in anthropology since the sixties. *Comparative Studies in Society and History* pp. 126–166.
- Patz, J. A. and Balbus, J. M. (1996) Methods for assessing public health vulnerability to global climate change. *Climate Research* 6(2), 113–125.
- Payne, M. (1996) Introduction: Some versions of cultural and critical theory. In *A Dictionary of Cultural and Critical Theory*. ed. M. Payne, pp. 1–12. Blackwell Reference, Oxford.
- Pred, A. and Watts, M. J. (1992) *Reworking Modernity: Capitalisms and Symbolic Discontent*. Rutgers University Press, New Brunswick, NJ.
- Price, M. F. (1990) Humankind in the biosphere: The evolution of international interdisciplinary research. *Global Environmental Change: Human and Policy Dimensions* 1, 3–13.
- Price, M. F. (1992) The evolution of global environmental change: Issues and research programmes. *Impact of Science on Society* 166, 171–182.
- Price, M. and Lewis, M. (1993) The reinvention of cultural geography. *Annals of the Association of American Geographers* 83(1), 1–17.
- Rayner, S. (1991) A cultural perspective on the structure and implementation of global environmental agreements. *Evaluation Review* 15(1), 75–102.
- Rayner, S., Bretherton, F., Buol, S., Fosberg, M., Grossman, W., Houghton, R., Lal, R., Lee, J., Lonergan, S., Olson, J., Rickwell, R., Sage, C. and van Imhoff, E. (1994) A wiring diagram for the study of land-use/cover change: Report of working group A. In *Changes in Land Use and Land Cover: A Global Perspective*. eds. W. B. Meyer and B. L. Turner, II. pp. 13–53. Cambridge University Press, Cambridge.
- Rayner, S. (1992) Review of *Global environmental change: Understanding the human dimensions*. *Environment* 34(7), 25–28.
- Rayner, S. (1995) Social solidarities and environmental separations. *Annals of the Association of American Geographers* 84(4), 715–721.
- Robertson, R. (1992) *Globalization: Social Theory and Global Culture*. Sage, London.
- Rockwell, R. C. and Moss, R. H. (1992) The view from 1996: A future history of research on the human dimensions of global environmental change. *Environment* 34(1), 12–17, 33–38.
- Rockwell, R. C. (1994) Culture and culture change. In *Changes in Land Use and Land Cover: A Global Perspective*, (eds.) W. B. Meyer and B. L. Turner, II pp. 357–382. Cambridge University Press, Cambridge.
- Rotmans, J. and van Asselt, M. (1996) Integrated assessment: A growing child on its way to maturity. *Climatic Change* 34, 327–336.
- Sachs, W. (ed.) (1993) *Global Ecology: A New Arena of Political Conflict*. Zed Books, London.
- Sack, R. D. (1990) The realm of meaning: The inadequacy of human-nature theory and the view of mass consumption. In *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 years*, eds. B. L. Turner, II, W. C. Clark, R. W. Kates, J. F. Richards, J. T. Mathews and W. B. Meyer, Cambridge University Press, Cambridge.
- Sayers, S. (1985) *Reality and Reason: Dialectic and the Theory of Knowledge*. Basil Blackwell, Oxford.
- Sayer, A. (1992) *Method in social science: A realist approach*. Hutchinson, London.
- Schwartz, M. and Thompson, M. (1990) *Divided We Stand: Redefining Politics, Technology and Social Choice*. Harvester Wheatsheaf, London.
- Shackley, S. and Wynne, B. (1995) Integrating knowledges for climate change: Pyramids, nets, and uncertainties. *Global Environmental Change* 5(2), 113–126.
- Stern, P. C. Young, O. R. and Druckman, D. ed. (1992) *Global Environmental Change: Understanding the Human Dimensions*. National Academy Press,

- National Research Council Committee on the Human Dimensions of Global Change, Washington, DC.
- Stern, P. C. and Dietz, T. (1994) The value basis of environmental concern. *Journal of Social Issues* **50**(3), 65–84.
- Stern, P. C., Dietz, T., Kalof, L. and Guagnano, G. A. (1995) Values, beliefs, and proenvironmental action: Attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology* **25**, 1611–1636.
- Subcommittee on Global Change Research (1995) *Our changing planet: The FY 1996 U.S. Global Change Research Program*. SGCR, Committee on Environmental and Natural Resources Research of the National Science and Technology Council, Washington, DC.
- Thompson, M., Ellis, R. and Wildavsky, A. (1990) *Cultural theory*, Westview Press, Boulder.
- Thompson, J. B. (1990) *Ideology and Modern Culture: Critical Social Theory in the Era of Mass Communication*. Stanford University Press, Stanford.
- Turner, II, B. L., Skole, D., Sanderson, S., Fischer, G., Fresco, L. and Leemans, R. (1995) Land-use and land-cover change: Science/research plan. International Geosphere-Biosphere Programme: A Study of Global Change and the Human Dimensions of Global Environmental Change Programme.
- Turner, B. L., Kates, R. W. and Meyer, W. B. (1995) The Earth as Transformed by Human Action in retrospect. *Annals of the Association of American Geographers* **84**(4), 711–715.
- van Asselt, M. B. A. and Rotmans, J. (1996) Uncertainty in perspective. *Global Environmental Change: Human and Policy Dimensions* **6**(2), 121–157.
- White, Jr. L. (1967) The historic roots of our ecologic crisis. *Science* **155**, 1203–1207.
- Williams, R. (1983) *Keywords: A Vocabulary of Culture and Society*. Oxford University Press, New York.
- Worster, D. (1988) The vulnerable earth: Toward a planetary history. In *The Ends of the Earth: Perspectives in Modern Environmental History*. ed. D. Worster, Cambridge University Press, Cambridge.
- Wynne, B. (1994) Scientific knowledge and the global environment. In *Social Theory and the Global Environment*, eds. M. Redclift and T. Benton, pp. 169–189. Routledge, London.