



In Focus: Landscapes over Time: Resilience, Degradation, and Contemporary Lessons

CHRISTOPHER T. FISHER
GARY M. FEINMAN
GUEST EDITORS

Introduction to "Landscapes over Time"

ABSTRACT There is a growing recognition that modern environmental problems bear striking resemblance to those faced by past societies and that to understand the environmental present we must consider the total sweep of anthropogenic environmental change on specific landscapes. This "In Focus" assembles five articles encompassing diverse time periods and different global regions to make the case that long-term perspectives on the relationship between people and their environmental contexts are critical for understanding and evaluating contemporary environmental debates, interpretations, and even policies. [Keywords: environmental degradation, archaeology, resilience, landscapes]

THE RECENT HOLLYWOOD BLOCKBUSTER *The Day After Tomorrow* (2004) popularizes a growing sentiment that "climate change is not just another issue, it is an overriding threat facing human civilization" (Gelbspan 2004a:24; see also Gelbspan 2004b). Implicit in this recognition is a sea change in the way that the human environment dialectic (Crumley 1994) is perceived. More specifically, there is a growing awareness that past human activity has induced a range of environmental changes. The realization that humans can fundamentally impact their physical surrounds so that the climate (once commonly thought to be outside the reach of human control) and other aspects of the environment may be significantly altered has become a powerful political reality that has galvanized scientific and public opinion (e.g., Macilwain 2004).

At the same time, many in the popular and scientific community have begun to recognize that the essential aspects of modern environmental problems have striking parallels to those faced by our counterparts in the past (e.g., Diamond 2003). And it is becoming increasingly clear that to understand the environmental present, and to manage-model our biota for the future, we must consider both contemporary human activities and the historic record of human presence on specific landscapes, and so the total sweep of anthropogenic environmental change (Dunning et al. 2002; Foster 2000; Foster et al. 2003; Lentz 2000; Motzkin et al. 1999; Redman 1999, 2000; Turner 1993; Turner et al. 2003).

In this "In Focus," we have assembled five articles by anthropologists working on diverse time periods in different global regions to make the case that long-term perspectives on the relationship between people and their environmental contexts are critical for understanding and evaluating contemporary environmental debates, interpretations, and even policies. Most of the authors have their own notions of how we might best accomplish this task and how we can foster a more nuanced understanding of past human-environment dynamics. As the Guest Editors of this "In Focus," we are fully cognizant that some of this territory has been covered before and that we build on the shoulders of earlier scholars (e.g., Adams 1978; Blakie and Brookfield 1987; Butzer 1982; Crumley 1994; Flannery 1972; Holling 1973; Vayda and McCay 1975). Here, however, we not only integrate theoretical streams from various bodies of research and theory but also incorporate data derived from new methodologies and techniques not available until recently (e.g., AMS dating, complex computer simulation, and new earth science techniques).

Each of the contributors to this "In Focus" approaches the discussion from the perspective of different empirical records, distinct geographic perspectives, and their own theoretical underpinnings, yet collectively these articles all explore three key themes: (1) How should we define human-environment interplays over time in a way that can ensure both multidisciplinary collaboration and an ability to communicate to wider constituencies; (2) what

paradigms, assumptions, and research programs must we share to facilitate the necessary communication that fosters and enables future research; and (3) what are the next steps?

DEFINING THE PROBLEM

Encoded in past land-use history are prior solutions to (and outcomes of) environmental challenges that are strikingly similar to their modern counterparts. For millennia, if not far longer, humans have had to cope with deforestation, soil erosion, desertification, loss of biodiversity, and climatic change (Denevan 1992; Krech 1999; Redman 1999). These same factors are often invoked as causal triggers responsible for the formation and decline of archaic societies around the globe (e.g., Diamond 2003; Gill 2000; see also Redman 1999).

In many regions of the world, changes in political power, demography, and social organization have been wavelike (Feinman 1998; Marcus 1992, 1998; Taagepera 1978, 1979). Likewise, climate and other environmental phenomena cycle and vary over time (e.g., Crowley 2000; Dean et al. 1985; Fresco and Kroonenberg 1992; Gunderson and Folke 2003; Jones et al. 2001; Whitlock and Bartlein 1997). Correlations between climatic and cultural changes are invoked in some regions as causal agents for change (often with careful testing); in other regions, they are routinely dismissed or left unconsidered. As discussed by David Johnson, Timothy Kohler, and Jason Cowan (this issue), it is impossible to assess and evaluate these relationships without a long-term perspective that takes into account the organizational, economic, and environmental parameters prior to, during, and after climatic and cultural events in a given region.

In *Science*, Donald Kennedy (2004:1565) recently editorialized that time depth for both human and environmental records is a prerequisite if we are to assess and explain correlations between human–environmental links and ultimately determine whether apparent trends are meaningful, directional, or neither (e.g., Crowley 2000). This is one key reason, among many, to advocate the collection of long-term socionatural data (deMenocal 2001). In the search for solutions to our current environmental woes, there is no need to reinvent the wheel—or, at least, not every spoke. Past successes and failures in environmental manipulation can inform modern land use and serve as potential guides for policy makers, as well as the general public.

For example, *desertification*, defined simply as the degradation of dry-land environments (see United Nations Convention to Combat Desertification [UNCCD] 2001), is a global conservation problem that has direct historical antecedents, which are all too frequently ignored. According to the United Nations, over 250 million people are directly affected by desertification, with over one billion people in over one hundred countries at risk (UNCCD 1994, 2001). Many regions that today cannot support large populations have rich archaeological legacies that signal very different

past environments. So what, exactly, triggered past episodes of desiccation and desertification?

As has been described lucidly by Graeme Barker, the origins of desertification are too often consigned to simplistic models based “more on speculation than evidence-based discussion” (2002:489). In regard to current ecotragedies, the UNCCD pins causation primarily on deforestation, overgrazing, and overpopulation (UNCCD 1994, 2001, 2004). In contrast, recent research on ancient Roman frontier settlements in Africa and Arabia has found that past desertification had little to do with climate change, mismanagement, land degradation, or overpopulation; instead, it was prompted largely by the economic integration of outlying regions into core zones (Barker 2002; Barker and Gilbertson 2000:13). In this and other archaeological studies (Barker and Gilbertson 2000; Dillehay and Kolata 2004; van der Leeuw and the ARCHAEOEMEDS Research Team 2000), desertification has been found to be the result of a complex web of human, natural, and other causations that cannot be assigned to univariate or prime-mover style models. This deeper, diachronic, more nuanced understanding of factors responsible for desertification demonstrates that there are few simple answers. Instead, desertification is the result of a complicated trajectory of induced and unintentional human change, with multiple causes and consequences for similar and different environments often following sociopolitical flux. Evaluating past trajectories of desertification can help us evaluate the suitability of ancient technologies for modern conservation; elucidate the role of climate, population, and technology in the continued formation of desiccated regions; and defuse political agendas demonizing ethnic groups (such as pastoralists) associated with lifestyles typically seen as degrading (Barker and Gilbertson 2000).

The participants in this “In Focus” are not alone in recognizing the potential role that historically grounded anthropology can have in shaping present interpretation and practice. There has been a broad call in the literature to examine long-term trajectories of socionatural relationships to define with greater precision concepts such as “sustainability,” “land degradation,” and “resilience” (Alverson and Oldfield 2000; Barker 1996; Brookfield 2001; Farina 2000; Fisher and Thurston 1999; Fisher et al. 2003; Foster et al. 2003; Redman 1999, 2000; Redman et al. 2004; Tainter 2000; Turner et al. 2003; van der Leeuw and Redman 2002; Vitousek et al. 1997; Zimmerer 2000a; Zimmerer and Bassett 2003). At the same time, some scholars have evaluated the potential of ancient forms of agrotechnology, agrarian organization, and land tenure with an eye toward new approaches for economic development (Altieri 1995; Denevan 1995; Erickson 2003). Indeed, Sander van der Leeuw and Charles Redman (2002) and Redman (this issue) make a convincing case that this sort of multidisciplinary research can provide a new focus for academic and public audiences helping explore contemporary policy and practices (see also McMichael et al. 2003).

Nevertheless, research on long-term human effects on the environment still falls below the radar of the general public, those who engage policy, scholars in related disciplines, and even many anthropologists. What has kept this avenue of research from reaching its potential audience?

DEVELOPING A PARADIGM TO EXAMINE LONG-TERM LANDSCAPE CHANGE

From our vantage point, a major stumbling block has been the lack of a unified body of concepts, theories, and hypotheses from which we can construct meaningful narratives for disciplinary and public consumption. Research on human–environment relations in the past is fragmented by subject matter (especially contemporary vs. historical approaches), discipline, and outlook. What is needed is a common language (*metalanguage*; see Van der Leeuw and Redman 2002) that can act as a bridge between the various factions pursuing these kinds of research agendas. We must seek new ways of modeling, testing, and synthesizing the complex relationship that our ancestors and we have shared with the planet.

What should form the core of this approach? At present, the issue is not the lack of a paradigm but, instead, the fact that we have too many competing options. It is easy to get lost among the variants of ecology (historical ecology, agroecology, and political ecology) and other related approaches (resilience theory, complexity theory, etc.). In this “In Focus,” we have brought together researchers from a broad spectrum of subject matter and approaches. Strikingly, they all share very similar conceptions of the human role in environmental change and how to conceptualize it, although they all have different theoretical perspectives, training, and intellectual background. Here we present three key elements underlying the case studies in this “In Focus.”

Theme I: Recursivity

Over the last decade or so, there has been a fundamental shift in the way that the society–nature connection is perceived (Blakie and Brookfield 1987; Cronon 1983, 1996; Descola and Pálsson 1996; Scoones 1999; Zimmerer 1994; Zimmerer and Young 1998). Recently, van der Leeuw and Redman (2002) traced a shift from a reactive to a proactive and then to an interactive conception of socionatural connections (see also Blakie and Brookfield 1987; Fisher 2000; Scarborough 2003a; Zimmerer 1994), replacing the traditional nature–culture dichotomy common in traditional Western thought (see Bryant 1992; Cronon 1996; Descola and Pálsson 1996; Escobar 1999; Giddens 1984) with a recursive view of human–environment interaction (see discussion in Redman [this issue]).

It is productive to conceptualize that environment and culture change in tandem and that this relationship is continually renegotiated at a variety of temporal and spatial scales. As humans engage with the environment, they construct their own niche, or landscape—that is, they modify

the environment in pursuit of social, political, and economic goals. Of course, at the same time, there are certain environmental challenges and perturbations that may be beyond human control, and these can be met with a suite of alternative responses.

One historical lesson centers on the resilience of anthropogenic landscapes and the legacy of human capital. The built environment has proved to be a powerful resource for past human societies; to evaluate modern landscapes, we need to understand the cultural repertoire that people bring to the present. Landscapes are additive amalgams that represent the sum total of natural and human (both intended and accidental) modification over millennial scales (Erickson 2000a; Fisher and Thurston 1999). In this sense, every aspect of the environment is a unique entity that cannot be understood apart from its historical trajectory. Nonetheless, there are commonalities in the solutions that humans have created to solve many complex problems, including technology and socioeconomic organization (see Scarborough 2003b).

The built environment has created long-lasting legacies of sociolandscape relationships that have remained stable for long time periods but are often susceptible to unforeseen crises. At century or millennial time scales, such anthropogenic environments seem sustainable—and, indeed, by modern definitions of the term, were successful—but such settings often were exposed to eventual catastrophe. Redman (this issue) suggests that this is a key reason why the concept of “sustainability” is inherently flawed. He argues, instead, for framing the issue in terms of more “resilient systems” with the capacity to react to unforeseen and unintended consequences in a rapid fashion.

A critical concept is that of “landesque capital,” originally coined by Harold Brookfield (1984:36; Blakie and Brookfield 1987:9; Brookfield 2001:55; Kirch 1994:19) to identify landscape manipulation designed for long-term gains in productivity. Landesque capital allows labor to be environmentally banked through stone walls, terraces, drainage and irrigation systems, raised fields, or other landscape infrastructure. Such “built” capital can increase productivity for generations if it is maintained. Landesque-capital landscapes are a common form of anthropogenic environment that occur across the globe.

A fundamental property of landesque-capital landscapes concerns what happens to them following steep demographic declines or abandonment. Landesque capital depends on regular allocations of labor to ensure stability. Degradation often results from a failure to repair and maintain agricultural infrastructure. A common pattern associated with such landscapes is long periods of relative stability and productivity, made possible by consistent labor inputs that maintain the system, followed by shorter episodes of land degradation caused by inadequate maintenance or abandonment. European colonialism (including the introduction of new technologies and species), changes in land tenure, the collapse of long-term systems of stratification and work, and epidemics (fomenting marked

demographic declines) all have been implicated as a trigger for this sort of land degradation, as is discussed by Christopher Fisher and Redman (both this issue; see also Blakie and Brookfield 1987; Butzer 1996; Denevan 2000; Dunning et al. 2002; Fisher et al. 2003; Runnels 2000; Spores 1969; van Andel et al. 1990; van der Leeuw and the ARCHAEOEDEDES Research Team 1998; Whitmore and Turner 2001; Zimmerer 1991, 1993, 2000a).

These findings challenge the seemingly straightforward connection that Jared Diamond (2003) has stressed between population pressure and land degradation. Although demography is certainly important for understanding human–environmental relations, it is far from resolved whether environmental damage generally is the direct product of high population densities and intensive systems of land use, or whether it occurs during demographic nadirs when highly maintained landscapes are left unattended. Empirically, there is no universal causal link between population growth and land degradation (see Fisher et al. 2003; Whitmore et al. 1990). In fact, as Fisher argues (this issue), degradation in some regions has been inversely correlated with population density (see also Redman this issue). Both scenarios conceivably could have played out under different circumstances, but it then remains incumbent on us to understand why.

Theme II: Landscape as Palimpsest

Modern environments are historically contingent entities that constantly reconfigure human choices and decision making at all scales. Landscape change is immutable, altering parameters governing stability, productivity, and potential (Blakie and Brookfield 1987:10–13). A landscape may return to a similar condition over a given period of time but will never again contain exactly the same suite of plants, animals, and general environmental conditions (e.g., Denevan 1992). Current human–environment choices are always conditioned by previous landscape decisions, often with unintended consequences (Cronon 1983, 1996; van der Leeuw and the ARCHAEOEDEDES Research Team 1998, 2000). As discussed by Fisher (this issue), using pre-Hispanic West Mexico as a case study, landscape decisions caused significant erosion that had to be repaired by subsequent populations, often at great cost to overall landscape stability.

Nevertheless, the recounting of these past land-use histories are often portrayed in fatalistic terms, with societies seen as making short-term decisions leading to environmental failures precipitated by some sort of mechanism outside of human control (see discussion in Redman this issue; Tainter 1988). In the history of human–environment relations, both successes and failures are driven by phenomena more complex than just population shifts, climate changes, or other universal drivers. In reality, never is it just an environmental story but, rather, a complex mosaic of human action, unintended consequence, and natural change, although some socionatural systems may be more susceptible to collapse than others (Janssen et al. 2003).

Anthropological archaeology also can enter the debate over the degree of human disturbance in past landscape processes to help define what exactly a “natural” landscape is. In the Americas, for example, there has been much debate over the *leyenda verde*, the idea that pre-Columbian environments were relatively untouched by humans (see discussion in Sluyter 2002; Whitmore and Turner 2001). Although the extent of human manipulation is debated (see Krech 1999, this issue; Mann 2002), it is clear that the precolonial American landscape was, at times, significantly modified by its indigenous inhabitants (Denevan 1992). As a result, most modern environments are the result of long-term, co-evolutionary symbioses that they shared with the human societies that helped create them (Denevan 1992; Dunning et al. 2002; Erickson 2000b; Fisher et al. 2003; McGlade 1995; Zimmerer 2000a).

As Shepard Krech discusses in his article (this issue), this complex interplay has led to public confusion over just what a natural landscape is and the role of Native Americans in modern conservation. There has been an increasing recognition that cultural landscapes are critical for the preservation of key habitats across the globe (Teutonico and Matero 2003) and that managing these anthropogenic environments (including suites of plants, animals, and lifeways that are often threatened) requires the implementation of traditional techniques of land management (Denevan 1995; Foster et al. 2003:86; Padoch et al. 1998). These anthropogenic constructions also encode past and present expressions of local (often indigenous) culture and can play a large role in the transmission of lifeways (Erickson 2003:194–195). Anthropological archaeology can provide technology, track records, and advice but cannot solve the social and cultural problems inherent in reinvigorating ancient systems of land use (Erickson 2003:190).

One goal of modern conservation, which would have been shared by ancient land managers, is the need to create information linkages among and between varying landscape components operating at different scales in time and space. As discussed by Fisher (this issue), such strategies have distinct implications for modeling scale-dependent concepts such as “land degradation” and “sustainability” (see also Barrow 1991; Bell and Morse 1999; Johnson and Lewis 1995; Kasperson et al. 1995; Zimmerer 2000b).

Theme III: Landscapes as Dynamic and Multiscalar Entities

For some time now, notions of ecosystems in balance have been questioned and often rejected in favor of flux, nonequilibrium dynamics and long-term change (Botkin 1990; Perry 2002; Turner 1993; Vayda and McCay 1975; Wu and Loucks 1995; Zimmerer 1994, 2000a; Zimmerer and Young 1998). Current ecological thinking emphasizes ecosystem dynamism with cyclical changes at many temporal and geographical scales (Botkin 1990; Zimmerer 1994, 2000a). The result is a landscape that is viewed as a heterogeneous mosaic of patches undergoing distinct successional regimes (Perry 2002:341). Shifting cultivation is just

one example of an intentional human strategy to increase environmental heterogeneity (Padoch et al. 1998). For landscapes, the seemingly contradictory normative notion of “disequilibria” means that humans constantly coped with flux while engineering more intensive production regimes on those landscapes.

Determining cause-and-effect relationships in socio-natural systems largely depends on the units of analysis and their associated scales in time and space (Butzer 1996; van der Leeuw and the ARCHAEOEMEDS Research Team 2000:363). Consideration of shorter temporal and spatial scales masks long-term trends but allows human action and environmental consequence to be elucidated. Larger scales allow broad patterns to be discerned but at some loss of precision to causal discrimination. Following van der Leeuw and the ARCHAEOEMEDS Research Team (2000), longer records are useful for inferences drawn, but for complete considerations, multiscale, inclusive records identifying short-term events and broad-scale trends are needed.

For example, one implication is that what appears to be a crisis at one temporal scale (one or two human generations) may seem like sustainable land management when viewed from a millennial lens (van der Leeuw and the ARCHAEOEMEDS Research Team 1998, 2000). Likewise, Redman argues that it is “only with long-term perspective that we can identify which of many seemingly beneficial near-term actions truly contributes to long-term resilience and recognize how some seemingly rational choices lead, in the end, to undesirable outcomes” (this issue).

All contributors to this “In Focus” agree that it is only through the *longue duree* that we can identify successful and detrimental sociolandscape strategies. So, how can we gather data, test hypotheses, and evaluate the long-term implications of current ecological manipulation? As demonstrated by Johnson, Kohler, and Cowan (this issue), sophisticated computer modeling in conjunction with archaeological investigation is one proven strategy of projecting past and current human strategies of land use into the future. The research strategy outlined by Fisher here also provides another investigative path.

THE NEXT STEPS

There is a growing recognition that past records of socio-natural interaction can help inform modern environmental problems and play a role in building a more resilient or sustainable lifeway for the future. Redman (this issue) outlines four unique contributions that anthropology alone can provide to create a more nuanced and sophisticated understanding of past socio-natural dynamics. To conclude this introduction, we build on Redman’s discussion, along with the other contributions to this “In Focus,” to explore additional issues that must be solved to extend the reach of research on ancient human impacts.

The most obvious starting point is to decide to whom, beyond the “choir,” we aim to communicate. In some respects, the question of audience mimics the actual nature of the phenomena itself in that it transcends simple

geographic and temporal scales. We first impart our message in our own discipline, then move on to a general scientific audience and the general public.

To accomplish this, it is necessary to deliver both simplified sound bites and more nuanced—but still jargon-free—recitation. There is little academic incentive to publish popular articles and books, although this is a fundamental component of public outreach. The hardest part of this prescription may be weaving our research into a coherent narrative that has relevance beyond anthropology and archaeology (e.g., Rolett and Diamond 2004).

We must also focus on ways to build bridges between disciplines (see Kates 1989; McMichael et al. 2003). It has been over 45 years since Charles Snow (1959) first published *The Two Cultures*, identifying the “Great Divide” between the natural and social sciences (or, more broadly, science and society); strikingly, human impacts research is still fragmented along those lines. Socio-natural investigation is fundamentally a multidisciplinary endeavor that pleases no discipline and so has no institutional-program loyalty and few venues for training, funding, and dissemination (van der Leeuw and Redman 2002:501).

To create institutional and other linkages, anthropologists must create a broad-based, integrative metalanguage. The primary lacuna is a body of concepts, theories, and variables that can act as a bridge at many levels. It is important that this approach be in a common scientific language that is accessible to both natural and social scientists, while integrating those studying contemporary and historical phenomena. It also must distinguish between short-term and long-term processes and incorporate multiscale phenomena, because socio-natural phenomena operate at many simultaneous temporal and spatial scales from the site, region, macroregion, and globe.

Human impacts research is further fragmented, within and between disciplines, into contemporary and historical approaches. Those studying recent environmental phenomena can more easily demonstrate how their findings articulate with modern economies and livelihoods. But they generally lack time depth and so have a limited understanding of diachronic change and, ultimately, lose an element of context and predictive value.

In contrast, historical approaches yield diachronic, multiscale views but lack the immediacy and vivid detail of the here and now. We must transcend a societal disconnect that recognizes the deep past as something akin to a century. How can we make a record on millennial scales relevant? Can we really say anything that will resonate beyond the last several hundred years? One way to accomplish this is through better integration between disciplinary and specialty niches by creating new venues for funding, dissemination, and discussion. The set of articles in this “In Focus” grew out of one such interdisciplinary conference held at Chicago’s Field Museum in March 2004. More meetings of a similar vein are needed that draw together disparate researchers so that we can see what we share in common and what we see differently. At the same time, articles such as

these will hopefully stimulate a greater recognition in this discipline as to the key role we should play in the interdisciplinary assessment of past and present interrelations between people and their surrounding landscape.

CHRISTOPHER T. FISHER Department of Anthropology, Kent State University, Kent, OH 44240

GARY M. FEINMAN Department of Anthropology, The Field Museum, Chicago, IL 60605-2496

NOTES

Acknowledgments. The articles in this collection were originally presented in March 2004 at the A. Watson Armour III Spring Symposium at The Field Museum in Chicago. We owe a debt of gratitude to The Field Museum, Provost Robert Martin, and all of those people who supported and facilitated the March program. We greatly appreciate the inspirations and challenges offered by the other symposiasts, the suggestions of an anonymous AA reviewer, the invaluable editorial assistance of Linda M. Nicholas, and the very helpful comments and constructive prodding of AA editor Susan H. Lees.

REFERENCES CITED

- Adams, Robert McC.
1978 Strategies of Maximization, Stability, and Resilience in Mesopotamian Society, Settlement, and Agriculture. *Proceedings of the American Philosophical Society* 122(1):329–335.
- Altieri, Miguel A.
1995 *Agroecology: The Science of Sustainable Agriculture*. Boulder, CO: Westview Press.
- Alverson, Keith, and Frank Oldfield
2000 PAGES—Past Global Change and Their Significance for the Future: An Introduction. *Quaternary Science Reviews* 19(1–5):3–7.
- Barker, Graeme
1996 Archaeological Contributions to Ecosystem Management. *SAA Bulletin* 14(2):19–21.
2002 A Tale of Two Deserts: Contrasting Desertification Histories on Rome's Desert Frontiers. *World Archaeology* 33(3):488–507.
- Barker, Graeme, and David Gilbertson, eds.
2000 *The Archaeology of Drylands: Living at the Margin*. London: Routledge.
- Barrow, Christopher
1991 *Land Degradation: Development and Breakdown of Terrestrial Environments*. Cambridge: Cambridge University Press.
- Bell, Simon, and Stephen Morse
1999 *Sustainability Indicators: Measuring the Immeasurable?* London: Earthscan Publications.
- Blaikie, Piers, and Harold Brookfield II
1987 *Land Degradation and Society*. London: Methuen.
- Botkin, Daniel
1990 *Discordant Harmonies: A New Ecology for the Twenty-First Century*. New York: Oxford University Press.
- Brookfield, Harold, II
1984 Intensification Revisited. *Pacific Viewpoint* 25(1):15–44.
2001 *Exploring Agrodiversity*. New York: Columbia University Press.
- Bryant, Raymond
1992 Political Ecology: An Emerging Research Agenda in Third World Studies. *Political Geography* 11(1):12–36.
- Butzer, Karl
1982 *Archaeology as Human Ecology: Method and Theory for a Contextual Approach*. Cambridge: Cambridge University Press.
1996 Ecology in the Long View: Settlement Histories, Agrosystemic Strategies, and Ecological Performance. *Journal of Field Archaeology* 23(2):141–150.
- Cronon, William
1983 *Changes in the Land: Indians, Colonists, and the Ecology of New England*. New York: Hill and Wang.
- Cronon, William, ed.
1996 *Uncommon Ground: Rethinking the Human Place in Nature*. New York: W. W. Norton.
- Crowley, Thomas J.
2000 Causes of Climate Change over the Past 1000 Years. *Science* 289:270–277.
- Crumley, Carole L.
1994 Historical Ecology: A Multidimensional Ecological Orientation. In *Historical Ecology: Cultural Knowledge and Changing Landscapes*. Carole L. Crumley, ed. Pp. 1–17. Santa Fe, NM: School of American Research Press.
- Crumley, Carole L., ed.
1994 *Historical Ecology: Cultural Knowledge and Changing Landscapes*. Santa Fe, NM: School of American Research Press.
- Dean, Jeffrey S., Robert C. Euler, George J. Gumerman, Fred Plog, Richard Hevley, and Thor N. V. Karlstrom
1985 Human Behavior, Demography, and Paleoenvironment on the Colorado Plateaus. *American Antiquity* 50(3):537–554.
- deMenocal, Peter B.
2001 Cultural Responses to Climate Change during the Late Holocene. *Science* 292:667–673.
- Denevan, William
1992 The Pristine Myth: The Landscape of the Americas in 1492. *Annals of the Association of American Geographers* 82(3):369–385.
1995 Prehispanic Agricultural Methods as Models for Sustainability. *Advances in Plant Pathology* 11:21–43.
2000 *Cultivated Landscapes of Native Amazonia and the Andes*. New York: Oxford University Press.
- Descola, Philippe, and Gisli Pálsson, eds.
1996 *Nature and Society: Anthropological Perspectives*. London: Routledge.
- Diamond, Jared
2003 The Last Americans: Environmental Collapse at the End of Civilization. *Harper's Magazine* 306(June):43–51.
- Dillehay, Tom, and Alan Kolata
2004 Long-Term Human Response to Uncertain Environmental Conditions in the Andes. *Proceedings of the National Academy of Sciences* 101(12):4325–4330.
- Dunning, Nicholas, Sheryl Luzzander-Beach, Timothy Beach, John Jones, Vernon Scarborough, and Patrick Culbert
2002 Arising from the Bajos: The Evolution of a Neotropical Landscape and the Rise of Maya Civilization. *Annals of the Association of American Geographers* 92(2):267–283.
- Erickson, Clark L.
2000a An Artificial Landscape-Scale Fishery in the Bolivian Amazon. *Nature* 408(6809):190–193.
2000b The Lake Titicaca Basin: A Precolumbian Built Landscape. In *Imperfect Balance: Landscape Transformations in the Precolumbian Americas*. David L. Lentz, ed. Pp. 311–357. New York: Columbia University Press.
2003 Agricultural Landscapes as World Heritage: Raised Field Agriculture in Bolivia and Peru. In *Managing Change: Sustainable Approaches to the Conservation of the Built Environment*. Jeanne Marie Teutonico and Frank Matero, eds. Pp. 181–204. Los Angeles: Getty Conservation Institute.
- Escobar, Arturo
1999 After Nature: Steps to an Antiessentialist Political Ecology. *Current Anthropology* 40(1):1–30.
- Farina, Almo
2000 The Cultural Landscape as a Model for the Integration of Ecology and Economics. *Bioscience* 50(4):313–320.
- Feinman, Gary M.
1998 Scale and Social Organization: Perspectives on the Archaic State. In *Archaic States*. Gary M. Feinman and Joyce Marcus, eds. Pp. 95–133. Santa Fe, NM: School of American Research Press.
- Fisher, Christopher T.
n.d. *Landscapes of the Lake Pátzcuaro Basin*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Wisconsin–Madison.

- Fisher, Christopher T., and Tina Thurston
1999 Introduction: Dynamic Landscapes and Socio-Political Process: The Topography of Anthropogenic Environments in Global Perspective. *Antiquity* 73(281):630–631.
- Fisher, Christopher T., Helen P. Pollard, Isabel Israde-Alcántara, Victor H. Gardño-Monroy, and Subir Banerjee
2003 A Reexamination of Human-Induced Environmental Change within the Lake Patzcuaro Basin, Michoacan, Mexico. *Proceedings of the National Academy of Sciences* 100(8):4957–4962.
- Flannery, Kent V.
1972 The Cultural Evolution of Civilizations. *Annual Review of Ecology and Systematics* 3:399–426.
- Foster, David R.
2000 Conservation Lessons and Challenges from Ecological History. *Forest History Today* (Fall):2–11.
- Foster, David, Frederick Swanson, John Aber, Ingrid Burke, Nicholas Brokaw, David Tilman, and Alan Knapp
2003 The Importance of Land-Use Legacies to Ecology and Conservation. *BioScience* 53(1):77–88.
- Fresco, Louise O., and Salomon B. Kroonenberg
1992 Time and Spatial Scales in Ecological Sustainability. *Land Use Policy* 9:155–168.
- Gelbspan, Ross
2004a Boiling Point. *Nation* 279(5):24–26.
2004b Boiling Point: How Politicians, Big Oil and Coal, Journalists, and Activists Are Fueling the Climate. New York: Basic Books.
- Giddens, Anthony
1984 *The Constitution of Society: Outline of the Theory of Structuration*. Cambridge: Polity Press.
- Gill, Richardson B.
2000 *The Great Maya Droughts: Water, Life, and Death*. Albuquerque: University of New Mexico Press.
- Gunderson, Lance H., and Carl Folke
2003 Toward a “Science of the Long View.” *Conservation Ecology* 7(1). Electronic document, <http://www.consecol.org/vol7/iss1/art15>, accessed October 22, 2004.
- Holling, Crawford S.
1973 Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics* 4:1–23.
- Janssen, Marco A., Timothy A. Kohler, and Marten Scheffer
2003 Sunk-Cost Effects and Vulnerability to Collapse in Ancient Societies. *Current Anthropology* 44(5):722–728.
- Johnson, Douglas L., and Laurence A. Lewis
1995 *Land Degradation: Creation and Destruction*. Cambridge: Blackwell.
- Jones, P. D., T. J. Osborn, and K. R. Briffa
2001 The Evolution of Climate over the Last Millennium. *Science* 292:662–667.
- Kasperson, Roger E., Jeanne Kasperson, William Turner III, Kirsten Dow, and William Meyer
1995 Critical Environmental Regions: Concepts, Distinctions, and Issues. *In* *Regions at Risk: Comparisons of Threatened Environments*. Roger E. Kasperson, Jeanne Kasperson, William Turner III, Kirsten Dow, and William Meyer, eds. Pp. 1–42. New York: United Nations University Press.
- Kates, Robert W.
1989 The Great Questions of Science and Society Do Not Fit Neatly into Single Disciplines. *The Chronicle of Higher Education* 35(36): B1, B3.
- Kennedy, Donald
2004 Editorial: Climate Change and Climate Science. *Science* 304(5677):1564–1565.
- Kirch, Patrick V.
1994 *The Wet and the Dry: Irrigation and Agricultural Intensification in Polynesia*. Chicago: University of Chicago Press.
- Krech, Shepard, III
1999 *The Ecological Indian: Myth and History*. New York: Norton.
- Lentz, David L., ed.
2000 *Imperfect Balance: Landscape Transformations in the Precolumbian Americas*. New York: Columbia University Press.
- Macilwain, Colin
2004 Head to Head. *Nature* 431(7006):238–243.
- Mann, Charles C.
2002 1491. *The Atlantic Monthly* 289(3):41–53.
- Marcus, Joyce
1992 Dynamic Cycles of Mesoamerican States: Political Fluctuations in Mesoamerica. *National Geographic Research and Exploration* 8(4):392–411.
1998 Peaks and Valleys of Ancient States: An Extension of the Dynamic Model. *In* *Archaic States*. Gary M. Feinman and Joyce Marcus, eds. Pp. 59–94. Santa Fe, NM: School of American Research Press.
- McGlade, James
1995 Archaeology and the Ecodynamics of Human-Modified Landscapes. *Antiquity* 69(262):113–132.
- McMichael, A. J., C. D. Butler, and Carl Folke
2003 New Visions for Addressing Sustainability. *Science* 302:1919–1920.
- Motzkin, Glenn, Paul Wilson, David Foster, and Allen Arthur
1999 Vegetation Patterns in Heterogeneous Landscapes: The Importance of History and Environment. *Journal of Vegetation Science* 10(6):903–920.
- Padoch, Christine, Emily Harwell, and Adi Susanto
1998 Swidden, Sawah, and In-Between: Agricultural Transformation in Borneo. *Human Ecology* 26(1):3–20.
- Perry, George
2002 Landscapes, Space and Equilibrium: Shifting Viewpoints. *Progress in Physical Geography* 26(3):339–359.
- Redman, Charles L.
1999 *Human Impact on Ancient Environments*. Tucson: University of Arizona Press.
2000 The Human Factor in Paleoclimate. *PAGES Newsletter* 8(3):4–5.
- Redman, Charles L., Steven R. James, Paul R. Fish, and Daniel Rogers, eds.
2004 *The Archaeology of Global Change: The Impact of Humans on Their Environment*. Washington, DC: Smithsonian Books.
- Rolett, Barry, and Jared Diamond
2004 Environmental Predictors of Pre-European Deforestation on Pacific Islands. *Nature* 431(7007):443–446.
- Runnels, Curtis
2000 Anthropogenic Soil Erosion in Prehistoric Greece. *In* *The Archaeology of Natural Disaster and Human Response*. Garth Bawden, ed. Pp. 11–20. Albuquerque: University of New Mexico Press.
- Scarborough, Vernon
2003a How to Interpret an Ancient Landscape. *Proceedings of the National Academy of Sciences* 100(8):4366–4368.
2003b *The Flow of Power: Ancient Water Systems and Landscapes*. Santa Fe, NM: School of American Research Press.
- Scoones, I.
1999 New Ecology and the Social Sciences: What Prospects for Future Engagement? *Annual Review of Anthropology* 28:479–507.
- Sluyter, Andrew
2002 *Colonialism and Landscape: Postcolonial Theory and Applications*. Lanham, MD: Rowman and Littlefield.
- Snow, Charles P.
1959 *The Two Cultures and the Scientific Revolution*. New York: Cambridge University Press.
- Spoes, Ronald
1969 Settlement, Farming Technology, and Environment in the Nochixtlán Valley. *Science* 166(3905):557–569.
- Taagepera, Rein
1978 Size and Duration of Empires: Growth-Decline Curves, 3000 to 600 B.C. *Social Science Research* 7:108–127.
1979 Size and Duration of Empires: Growth-Decline Curves, 600 B.C. to 600 A.D. *Social Science History* 3:115–138.
- Tainter, Joseph
1988 *The Collapse of Complex Societies*. Cambridge: Cambridge University Press.
2000 Global Change, History, and Sustainability. *In* *The Way the Wind Blows: Climate, History, and Human Action*. Roderick McIntosh, Joseph Tainter, and Susan Keech

- McIntosh, eds. Pp. 331–356. New York: University of Columbia Press.
- Teutonico, Jeanne Marie, and Frank Matero, eds.
2003 *Managing Change: Sustainable Approaches to the Conservation of the Built Environment*. Los Angeles: Getty Conservation Institute.
- The Day After Tomorrow
2004 Roland Emmerich, dir. 124 min. 20th Century Fox. Hollywood.
- Turner, Billie L., II
1993 Rethinking the “New Orthodoxy”: Interpreting Ancient Maya Agriculture and Environment. *In* *Culture, Form, and Place: Essays in Cultural Historical Geography*. Kent Mathewson, ed. Pp. 57–88. Baton Rouge: Louisiana State University.
- Turner, Monica G., Scott L. Collins, Ariel L. Lugo, John J. Magnuson, Scott Rupp, and Frederick J. Swanson
2003 Disturbance Dynamics and Ecological Response: The Contribution to Long-Term Ecological Research. *BioScience* 53(1):46–56.
- United Nations Convention to Combat Desertification (UNCCD)
1994 Intergovernmental Negotiating Committee for the Elaboration of an International Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa. Fifth Session, Paris, June 6–17, 1994. New York: United Nations.
- 2001 Report of the Ad Hoc Working Group the Fifth Session of the Conference of the Parties. Bonn, March 19–April 6, 2001. New York: United Nations.
- 2004 10 Years On: Preserving Our Common Ground. New York: United Nations.
- van Andel, Tjeerd H., Eberhard Zangger, and Anne Demitrac
1990 Land Use and Soil Erosion in Prehistoric and Historical Greece. *Journal of Field Archaeology* 17(4):379–396.
- van der Leeuw, Sander E., and Charles L. Redman
2002 Placing Archaeology at the Center of Socio-Natural Studies. *American Antiquity* 67(4):597–605.
- van der Leeuw, Sander E., and the ARCHAEOEMEDS Research Team, eds.
1998 *The Archaeomedes Project: Understanding the Natural and Anthropogenic Causes of Land Degradation and Desertification in the Mediterranean Basin*. Luxembourg: European Commission.
- 2000 Land Degradation as a Socionatural Process. *In* *The Way the Wind Blows: Climate, History, and Human Action*. Roderick McIntosh, Joseph Tainter, and Susan Keech McIntosh, eds. Pp. 357–383. New York: University of Columbia Press.
- Vayda, Andrew P., and Bonnie J. McCay
1975 New Directions in Ecology and Ecological Anthropology. *Annual Review of Anthropology* 4:293–306.
- Vitousek, Peter M., Harold A. Mooney, Jane Lubchenco, and Jerry M. Melillo
1997 Human Domination of Earth’s Ecosystems. *Science* 277(5325):494–499.
- Whitlock, Cathy, and Patrick J. Bartlein
1997 Vegetation and Climate Change in Northwest America during the Past 125 Kyr. *Nature* 388(6637):57–61.
- Whitmore, Thomas M., Billie L. Turner II, David L. Johnson, Robert W. Kates, and Thomas R. Gottschang
1990 Long-Term Population Change. *In* *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years*. Billie L. Turner II, William C. Clark, Robert W. Kates, John F. Richards, Jessica T. Mathews, and William B. Meyer, eds. Pp. 25–39. Cambridge: Cambridge University Press with Clark University.
- Whitmore, Thomas M., and Billie L. Turner II
2001 *Cultivated Landscapes of Middle America on the Eve of Conquest*. Oxford: Oxford University Press.
- Wu, Jianguo, and Ori L. Loucks
1995 From Balance of Nature to Hierarchical Patch Dynamics: A Paradigm Shift in Ecology. *Quarterly Review of Biology* 70(4):439–466.
- Zimmerer, Karl S.
1991 Labor Shortages and Crop Diversity in the Southern Peruvian Sierra. *Geographical Review* 81(4):415–432.
1993 Soil Erosion and Labor Shortages in the Andes with Special Reference to Bolivia, 1953–91: Implications for “Conservation-with-Development.” *World Development* 21(10):1659–1675.
1994 Human Geography and the “New Ecology”: The Prospect and Promise of Integration. *Annals of the Association of American Geographers* 84(1):108–125.
2000a The Reworking of Conservation Geographies: Nonequilibrium Landscapes and Nature-Society Hybrids. *Annals of the Association of American Geographers* 90(2):356–369.
2000b Rescaling Irrigation in Latin America: The Cultural Images and Political Ecology of Water Resources. *Ecumene* 7(2):151–175.
- Zimmerer, Karl S., and Kenneth R. Young
1998 *Nature’s Geography: New Lessons for Conservation in Developing Countries*. Madison: University of Wisconsin Press.
- Zimmerer, Karl S., and Thomas J. Bassett
2003 *Political Ecology: An Integrative Approach to Geography and Environment-Development Studies*. New York: Guilford Press.