PACIFIC STUDIES

SPECIAL ISSUE
SUSTAINABILITY IN THE SMALL ISLAND STATES
OF THE PACIFIC

Volume 22, Numbers 3/4 September/December 1999

INTRODUCTION: DEFINING AND UNDERSTANDING SUSTAINABILITY IN SMALL ISLAND STATES

Charles J. Stevens
Miami University
Oxford, Ohio

THE ARTICLES IN THIS VOLUME represent the culmination of a protracted discourse that started with an informal session titled "Sustaining Islanders: The Political Ecology of Small Island States" at the Association for Social Anthropology in Oceania (ASAO) meetings in 1994. The idea for the session began with a discussion between Mike Evans and me a couple of years earlier. While we both worked in Tonga, Evans's research interests focused on kin-based systems of gift giving and socioeconomic relations founded in exchange. My own interests were in understanding changing systems of agroecology and the economic strategies of smallholder agriculturalists in Tonga who managed an internationally distributed array of resources in agricultural and nonagricultural labor and production. From my perspective agriculture, smallholder management, and chiefly administration in Tonga had provided a reasonably unambiguous demonstration of a process that had remained stable, productive, and resilient for several thousand years but less so since World War II. Evans had witnessed the strength and durability of a kin system whose members were in Haʻapai, Tongatapu, Pago Pago, Suva, Auckland, Sydney, and along the North American Pacific coast from Los Angeles to Vancouver and inland to Salt Lake City. For both of us, though in different ways, our work revolved around the somewhat fuzzy concept of sustainability. As co-organizer of the session, I had the relatively unostentatious expectation of getting together a number of anthropologists with interests in the intersection of political economics and cultural ecology in the islands of the Pacific Ocean. As the session came together, it became clear

that a discussion of the social, economic, ecological, and cultural dimensions of "sustainability," as the process of maintaining what is valued for a long time, was inevitable and necessary.

Despite the complexity of the relationships among cultivar biodiversity, labor-intensive resource management, stability of production, unpredictable market forces, and peasant risk-minimizing strategies, agriculture presents a reasonably clear construct of "sustainability." The ecological and productive utility of multicropping, intercropping, agrobiodiversity, and maintaining soil structure and fertility through labor-intensive use of local resources have become increasingly well understood and offer a stark contrast to the industrial agriculture of the West, which is dependent on nonrenewable and finite reserves of petroleum and is known to be the single largest source of non-point-specific pollution on the planet (Gleissman 1998). Sustainability, I thought, was seemingly well understood in agroecology circles and would be similarly understood elsewhere. Perhaps the term could be unambiguously applied to fisheries and forests in Samoa, Arno, Tonga, and Kapingamarangi, and from shepherds in New Zealand to development projects and government policies in the Federated States of Micronesia. In various ecological settings and in a host of political-economic contexts, production systems were either likely to last for a long time or not.

The first question raised in our initial informal meeting was "What do we mean by the term 'sustaining' in the title of our session?" Sustaining what, for whom, by whom, in what political economic context, and for how long? Ecological economists had defined sustainable as "the amount of consumption that can be continued indefinitely without degrading capital stocks—including 'natural capital' stocks" (Costanza, Daly, and Bartholomew 1991:8). Anthropologists were fidgety and uncomfortable in the presence of such unquestioned neoliberal concerns with (however implied) concepts of maximized consumption and simple cost-benefit analysis. Our collective attention turned to the disparity between the rhetoric of sustainable development articulated in government policy and what indigenous Pacific people were actually doing with regard to management of cultural and environmental resources. Since "sustainability" in the Western nations arises primarily from concerns about environmental degradation and the development of environmental ethics, how were we to discuss this issue in the context of Pacific people who, despite having practiced agroforestry, husbandry, and gathering of marine resources for thousands of years, exhibited no clear indigenous conservation ethic (Olson 1993; see also the Shankman and Stevens articles in this volume)? Yet, clearly something was being sustained.

We posted our concerns to the ASAO electronic discussion list, and there followed a several-months-long discussion about sustainability and the utility

of the term for anthropologists' involvement with Pacific Islands peoples. One aspect of sustainability became clear: if the productive capabilities of the Pacific people were maintained and appeared for some period of time to be stable and resilient, it is because knowledgeable human actors made it so. Sustainability was a characteristic of anthropogenesis, and human agents acted on their own ideas about what was to be sustained and how. The manner in which a productive system is maintained by actors on an ecological landscape implies certain needs and requirements of the social system. In agriculture, complex agroforestry systems in the Pacific sustain soil fertility and agrobiodiversity and ensure long-term productive yields, and, conversely, maximizing market-crop production, removing trees, and purchasing fertilizers quickly provides needed currency to smallholder households. Both serve to "sustain" existing relations of production. Tropical island ecosystems separate from human actors have no teleological motivations for maintaining stability or fostering change. The farmers and fishers who manage ecological systems, however, determine resource utility, and people's changing needs become manifest in the condition of the environment. Our concern in the organization of the symposium and in the essays in this volume that came out of it was to document both changing human-resource interactions in Micronesia and Melanesia, and the political-economic and cultural influences on farmers' and fishers' resource management activities. This concern reflects our collective conclusion that it is "in the mix" that sustainability lies.

Concepts of Sustainability

> *Sustainability* is a relationship between dynamic human economic systems and larger dynamic, but normally slower-changing ecological systems, in which 1) human life can continue indefinitely, 2) human individuals can flourish, and 3) human cultures can develop; but in which effects of human activities remain within bounds, so as not to destroy the diversity, complexity, and function of the ecological life support system. (Costanza, Daly, and Bartholomew 1991:2–3)

The term "sustainability" was apparently first used as a criticism of industrialization in *The Ecologist* magazine's *Blueprint for Survival,* published in 1972. This was at a time when the canons of modernism were first being subjected to serious scholarly criticism in dependency theory proposed by Andre Gundar Frank (1966), in *The Limits to Growth* computer-simulation report by Meadows and Meadows (1972) of the Massachusetts Institute of Technology, by the subsequent reports of the Club of Rome, and by philosophical postmodernists like Capra (1983). Interest in issues of sustainability,

as lasting and stable economic systems, derives from a theoretical political ecology concerned with designing future modes of production that do not degrade the natural ecosystem. This concern is based, in part, on reflection on the political economic events of the nineteenth and twentieth centuries and the realization that whatever benefits modernization may have brought to the world's human population, these do not include lessons in effectual stewardship of limited resources and their equitable distribution. The philosophical roots of concerns with sustainability are postmodern, or at least antimodern, but the analytical tools of most scholars interested in the issue have not reflected wholesale rejection of the exacting, pragmatic, or rigorously empirical methods of Eurocentric scientific inquiry. However, questioning the superiority of the modern over the premodern and doubting the validity of rigid disciplinary boundaries between the natural sciences, the social sciences, and the arts is part of the analytical perspective accepted by agroecologists (Altieri 1987; Gleissman 1989; Nair 1989), agronomists (Thurston 1992; Hoekstra and Kuguru 1983), geographers (Bayliss-Smith 1982; Clarke and Thaman 1993), biologists (Huston 1979; MacArthur and Wilson 1967; Wilson 1992; Reice 1994; and see Worster 1990), and policy consultants (National Research Council 1989).

The term "sustainability," as Netting has noted, "is a prime candidate to be the watchword of the 1990's" (1993:143); indeed the notion, however variously defined, has reached a point of substantial popularity in "green" and, in contrast, economic development circles. Most of the definitions of the term include ecological as well as economic and social connotations (Barbier 1987:104). The various definitions accent environmental restrictions, economic dimensions, and social characteristics of resource distribution and place those parameters in "contexts of changing interactions" (Netting 1993: 143): the latter referring to the historical process of changing relations between humans and their environment, and between humans and their spheres of social and economic relations. Smallholder agriculturalists and fishers have frequently been portrayed as managing resources under environmental restrictions, operating in complex economic and political contexts, and practicing stable systems of reciprocal obligation in resource distribution.

So, agricultural sustainability, as a part of economic sustainability, could be relatively unambiguously measured and defined as the ability of the agricultural system to maintain productive social relations in the face of climatic perturbations and political stresses without permanent environmental degradation. Thus, sustainability is seen as a function of the environmental aspects of the system, the nature of the stresses on the system causing change, and the individual and societal enterprise necessary to counter the stresses imposed on it (Stevens 1996:101). Netting (1993) focuses on the smallholder farmer where a variety of on- and off-farm strategies and the family farm's

intergenerational and familial focus lead to resource conservation practices and a decreased concern for short-term profit maximization at the cost of resource degradation. He presents convincing evidence that smallholder agriculture, practiced by an overwhelming proportion of the world's farmers (Netting 1989:221), can maintain impressive yields per unit of land without degrading the resource base on which continued production depends. He states that "the success of smallholder cultivation is not only its large and dependable production but its ecological continuity and conservation, its *sustainability,* in the currently popular phrase" (ibid.:224; italics in original).

Historically, sustainability was not thought to have been characteristic of most indigenous economic systems in the face of European expansion, although such systems are presumed to have been sustainable before capitalist penetration (Klee 1980). This assumption may be more a matter of romanticized notions of indigenous human-land relations than the actual case, as the ecological archaeology of the Pacific indicates (Kirch 1982; Steadman 1995; Kirch and Hunt 1997). What is certain, however, is that modern human-land relationships characteristic of industrial agriculture consume resources at far greater rates than the natural capacity for replenishment and, measured in kilocalories, return very poor production per unit of energy input (Ellis 1987; National Research Council 1989). Equally certain is that many pre-European resource management strategies in the Pacific were sustained for several thousands of years despite the ecological consequences of the initial colonization of islands and returned very large yields per unit of land (Clarke and Thaman 1993; Stevens 1996). Even without a conservation ethic, relative sustainability of the landscape and seascape was apparent.

Indigenous farmers, even on small Pacific islands, developed agricultural systems whose productive capabilities belied the fragility of the environment. Social organizing principles—social hierarchies and chiefdoms—may well have been established to minimize social causes of disruption and to mobilize efforts rapidly to rectify the destructive consequences of unpredicted natural perturbations. As well, a host of risk-minimizing agronomic practices were designed not to control the production and distribution of resources during average years, but to mitigate the disruptive effects of occasional, unpredictable environmental perturbations. To the extent that natural ecosystems are in states of continuous chaotic activity, it was the role of indigenous farmers to impose stability of production onto a chaotic nature.

The design of kin-based distributive networks, the invention of food-storage techniques, and the land management practices of, for example, Tongan farmers (see Stevens 1996) and New Zealand shepherds (see Dominy, this volume) ensured high yields of crops or of fleece, and the effects of storms and occasional droughts were insufficient to disrupt production over the long

haul. The authority of chiefs in traditional Polynesia (Sahlins 1958; Kirch 1984) and the distribution of power and control along family lines and through competent chiefly administration ensured sociocultural resilience to times of ecosystem and productive stress. These practices provided farmers some assurance of making it through times of shortage caused apparently not as much by the inherent limitations of their environment as by the effects of minimally predictable environmental perturbations.

At any level of analysis higher than the farm, however, sustainability is difficult to define. Central in these definitional problems is the resolution of perceived discrepancies between economic and ecological perspectives regarding the role of markets and of social institutions in system sustainability. Neoclassical economists are committed to a model in which continued population growth, resource constraints, and insatiable human needs lead to improved market production and, in a linear fashion, to increased labor specialization and increased interdependency between individualized consumers and producers. In this view, development of "sustainable markets" necessarily involves continued allocation of resources to the maintenance and perpetuation of commodity production. In a context of limited resources, such a proposition is untenable.

Scholarly concern with the economic dimension of sustainability has prompted the formation of the new "transdisciplinary field of study" of ecological economics (Costanza, Daly, and Bartholomew 1991). Ecological economics differs from conventional economics in its realization of the disastrous, long-term consequences of "decisions made on the basis of local, narrow, short-term criteria." It addresses the relationship between ecological systems and economic systems by using the tools available from both of these disciplines and from other disciplines (such as medicine) for a thorough understanding of environment-economy interactions. A great deal of the stimulus for ecological economics has come from the work of Herman Daly and John Cobb (1989), who suggest the need for a paradigm shift in economics questioning some of the fundamental assumptions of neoclassical economics.

Daly and Cobb argue against many of the most basic assumptions of economists and note that "the market is not the end of society and is not the right instrument through which the ends of society should be set" (1989:14). They support decentralization of political and economic power but favor private ownership of the means of production when private ownership is not concentrated in a few hands. While criticizing the centrality of individualism in classical economics, they remain convinced of the soundness of market principles and seek to expand the classical economic paradigm to include the larger ecological contexts in which it operates. Ecological economics, however, offers little distinction between development and growth in terms of either how development, as opposed to growth, necessarily entails restricted use of

limited natural resources. There is no recourse to truly alternative or creative economic system description and development in the ecological-economic camp other than a slight modification of neoclassical economic practices. Indeed, for all of the well-considered criticisms of contemporary economic activity by ecological economists, such as their criticisms of doctrines justifying externalization of costs, defining myopic concepts of valuation, or discounting investments in the future, the constructs of ecological economics and its definitions of sustainability are thoroughly steeped in the ideology of neoclassical economics.

Costanza, Daly, and Bartholomew, for example, note that "conventional economic and ecological models and concepts fall far short in their ability to deal with global ecological problems" (1991:2), but they define alternative and sustainable economics entirely in neoclassical terms, stating that sustainability is the "amount of consumption that can be sustained indefinitely without degrading capital stocks—including 'natural capital' stocks" (ibid.:8). This approach ignores the many examples of more-sustainable human economic behavior, historically and in the "modern" era, that are non-Western in origin and provide evidence of economic systems not based on ideologies of progress, pure economic rationality, or maximized consumption. Many of these examples come from anthropological portrayals of practically reasoned economics where notions of rationality as mere maximized utility do little to explain either human-resource interactions or human social relations.

Sustaining Islanders

What can anthropologists studying Micronesian and Polynesian peoples contribute to the discourse of sustainability? Can we add conceptual or methodological insights that will demonstrate the ineffectiveness of contemporary development paradigms, now couched in terms of "sustainable economics," or point toward new approaches to improving Pacific Islander livelihood and maintenance of their cultural affinities? As the participants met in sessions at the Association for Social Anthropology in Oceania meetings from 1994 to 1998, we began to center our attention on the common threads that connected our diverse papers. That common thread was found by focusing on the nature of Pacific Islander constructions of the environment as a template for preservation of family relations. We noted that the dichotomy of "nature" and "culture" was not particularly characteristic of the ideology of production that informed Polynesian and Micronesian economics centered on sustaining the ecology of social relations. Land and sea were resources for supporting the primacy of family and maintaining corporate kin ties whose preservation meant survival in times of scarcity and pleasure in times of plenty. The terrestrial environment of islands, particularly, was socially constructed

by islanders from the moment of initial colonization. Sustaining kin relations did not translate into "sustainable production" as defined by Western (or Northern) concepts of economic efficiency and environmental maintenance, although that "template" was found in all of the Pacific Islands states' national development plans and South Pacific Commission environmental assessments.

Political-economic change brought maximizing technologies and maximizing ideologies that were adopted by Pacific Islanders to meet kin-based, social, and church-mandated obligations. Competitive feasting and church donations were enhanced by the presence of outboard motors and nylon nets for improved fishing, chainsaws for land clearing, labor out-migration for access to funds, and John Deere tractors for tillage and land preparation. These changes came rapidly, and the ecological and social consequences of their adoption came later in the form of eroding soil fertility, deforestation, and changed relations of production—costs absent from development bank ledgers but prominent in islander well-being.

Paul Shankman noted in our discussions that Pacific Islanders were communal people with communal ideologies whose productive activities were for communal purposes organized under communal control. The conceptual and productive constraints that accompanied these communal ideologies and controls resulted in sustained relations, sustained production, and sustained capacity for production. The Tongan farmers with whom I worked understood immediately my research interests in sustainability *(poupou mo fakatolonga)* of agroforestry production, but many farmers remained largely unconcerned with decreasing soil fertility and saw no relevance in loss of biodiversity. The possible consequences of tractor tillage, pesticide application, and market-crop production, which some farmers understood, were insignificant compared to the consequences of unmet family obligations, and failing in one's *fatongia* (duty) was far more serious than environmental disruption. Sustainability, then, is a set of relationships between the environment and the producers, among producers themselves enmeshed in a cultural milieu that prescribes economic activity, and encompassing political-economic changes that directly alter human-resource relations. If one aspect of the relationship is privileged in the context of changed productive capabilities, another set of relationships suffers. In the Pacific, family and kin relations are privileged, maximizing technologies are accepted because they foster meeting those obligations, and the environmental bases of production may suffer.

The history of the changes in these sets of relationships is a common factor in all the articles presented here. These relationships between environment and technology, environment and culturally prescribed economic activity, and external forces of production and internal means of production are nowhere better illustrated than in Michael Lieber's systems view of sustainability focusing on the analysis of activities of Kapingamarangi fishermen.

Fishing practices on Kapingamarangi Atoll were once organized through the men's house, based on compliance with an external order of gods who controlled specific areas radiating out from the atoll. Communal labor was hierarchically organized and production practices based on relatively predictable variation in wind and surface conditions, while priests served as liaisons between the unpredictable spirits and the Kapinga fishermen. Change at the social level as a consequence of new external orders brought by Japanese and American administrations rendered previously sustained social relations and fishing technologies obsolete and therefore unsustainable.

Such complexities are seldom considered when policy decisions, all expressing concerns with "sustainable development" or "sustainable relations," are made by "top-down" development planners. Karen Nero's analysis of the Marshall Islands demonstrates that the utility of the term "sustainability" depends on understanding its definition at local, national, and international levels. Perspectives based on dichotomized notions of economy, subsistence and market, traditional and modern, fail to recognize the plurality of philosophically and practically antithetical economic systems in the Marshall Islands: the Marshallese chiefly and extended family redistributive economy, the governmental redistributive economy (involving subsidized public services), and a Western user-pays economy. Similarly, Jim Hess presents three accounts of the sustainability of a fishing development project in Arno, Marshall Islands. His first account of the fishing market development project focuses on monetary costs and benefits, and determines that, at this level of analysis, the project is unsustainable. At the level of international relations, the Arno Atoll Fisheries Association project serves to sustain existing unequal relations of power and dependency. Finally, Hess suggests that assessments of success or failure must be historical and consider the costs of lost knowledge and imposition of new knowledge and values.

Michèle Dominy explores different, competing discourses of sustainability and the emergence of a land ethic in New Zealand's South Island high country. Here a long history of competing interests and changing concepts of land, culture, identity, and nation prevent facile and simplistically catholic concepts of sustainability. Dominy records the historical contestation of the idea of sustainability and what is sustainable as environment, community, and identity, demonstrating that there is a fight for proprietary ownership of ideas as well as landscape. Whereas emotional ties to the land define what has value and is, therefore, to be sustained in a particular way in New Zealand's high country, Evans shows that the family is what is valued and sustained by Tonga's transnational system of emotional ties. The Tongan and Samoan kin-based system of resource distribution fosters deep feelings of obligation and reciprocity that inform the exchange of material goods as emotional markers of kinship and community. Evans asserts that what is sustain-

able in Tonga's contemporary political economy is the now transnational system of emotional and monetary ties that expand Tonga's limited productive capabilities. Governmental decisions to limit these ties are important, but the determination and motivation of islanders to maintain these emotional ties are more significant predictors of sustainable relations.

Shankman's and Stevens's articles present historical ecological discussions demonstrating the loss of previously sustained environmental resources. Shankman presents a history of the deforestation of Samoa contextualized in changing ideas about development and sustainability. While early hopes for Samoa's economic development centered on its agricultural potential, later efforts were geared toward extraction of Samoa's valuable tropical timber. Local and customary ownership of forest resources slowed development in this arena and contributed to rendering early corporate investment in timber extraction unprofitable. In the latter part of the century, after foreign foresters had departed, deforestation became the consequence of privatization of the once communally held forests. Stevens portrays similar loss of ecological resources in the recent changes to Tonga's highly productive agroforestry system. Again, the primary actors are Tongan smallholders sustaining relations among related households and among households, the church, and the state, but they have been enticed into the global market by Japanese business enterprises and regional and governmental development goals. The slow-to-develop ecological consequences of tractor tillage and the use of petroleum-based inputs lag far behind the immediate economic benefits of market-crop production and the significance of sustaining social ties.

All of the articles here take the common assumption of the anthropological approach, that is, that humans have agency (or at least behave as if they do). The human-ecological nexus is more complex than ecology or economics alone, and thus so too is anything one might call sustainability. Some concept of value lies at the heart of human action, and for anthropologists generally and in the view of the authors of the articles in this volume, if the notion of sustainability is to have value, we must start with the exploration of human activity as a value-laden process of sometimes sustainable result.

REFERENCES

Altieri, Miguel A.
1987 *Agroecology: The Scientific Basis of Alternative Agriculture.* Boulder, Colo.: Westview Press.

Barbier, Edward B.
1987 The Concept of Sustainable Economic Development. *Environmental Conservation* 14 (2): 101–110.

Bayliss-Smith, T. P.
1982 *The Ecology of Agricultural Systems.* Cambridge: Cambridge University Press.

Capra, Fritjof
1982 *The Turning Point: Science, Society, and the Rising Culture.* New York: Bantam Books.

Clarke, W. C., and R. R. Thaman
1993 *Agroforestry in the Pacific: Systems for Sustainability.* Tokyo: United Nations University Press.

Connell, Joseph H.
1978 Diversity in Tropical Rainforests and Coral Reefs. *Science* 199:1302–1310.

Costanza, Robert, Herman E. Daly, and Joy A. Bartholomew
1991 Goals, Agenda, and Policy Recommendations for Ecological Economics. In *Ecological Economics: The Science and Management of Sustainability,* ed. Robert Costanza, 1–20. New York: Columbia University Press.

Daly, Herman E., and John B. Cobb Jr.
1989 Introduction. In *For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future,* ed. Herman E. Daly and John B. Cobb Jr., 1–21. Boston: Beacon Press.

Ellis, Frank
1987 *Peasant Economics: Farm Households and Agrarian Development.* Cambridge: Cambridge University Press.

Frank, Andre Gundar
1966 The Development of Underdevelopment. *Monthly Review* 18:17–31.

Gleissman, Stephen R., ed.
1998 *Agroecology: Ecological Processes in Sustainable Agriculture.* Chelsea, Mich.: Ann Arbor Press.

Hoekstra, D. A., and F. M. Kuguru, eds.
1983 *Agroforestry Systems for Small-scale Farmers.* Nairobi: ICRAF/BAT.

Huston, Michael
1979 A General Hypothesis of Species Diversity. *American Naturalist* 113 (1): 81–101.

Kirch, Patrick V.
1982 The Impact of Prehistoric Polynesians on the Hawaiian Ecosystem. *Pacific Science* 36:1–14.

Kirch, Patrick V., and Terry L. Hunt
1997 *Historical Ecology in the Pacific Islands: Prehistoric Environmental and Landscape Change.* New Haven: Yale University Press.

Klee, G.
1980 *World Systems of Traditional Resource Management.* New York: Halstead.

MacArthur, Robert, and Edward O. Wilson
1967 *The Theory of Island Biogeography.* Princeton, N.J.: Princeton University Press.

Meadows, Donella, and Dennis Meadows
1972 *The Limits to Growth.* New York: Penguin Putnam.

Nair, P. K. R.
1989 *Agroforestry Systems in the Tropics.* Dordrecht: Kluwer Academic Publishers.

National Research Council
1989 *Alternative Agriculture.* Washington, D.C.: National Academy Press.

Netting, Robert M.
1989 Smallholders, Householders, Freeholders: Why the Family Farm Works Well Worldwide. In *The Household Economy: Reconsidering the Domestic Mode of Production,* ed. Richard R. Wilk, 221–244. Boulder, Colo.: Westview Press.
1993 *Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture.* Stanford, Calif.: Stanford University Press.

Olson, Ernest
1993 Conflict Management in Congregation and Community in Tonga. Ph.D. dissertation, University of Arizona, Tucson.

Reice, Seth R.
1994 Nonequilibrium Determinants of Biological Community Structure. *American Scientist* 82:424–435.

Sahlins, Marshall D.
1958 *Social Stratification in Polynesia.* Seattle: University of Washington Press.

Steadman, David
1995 Prehistoric Extinctions of Pacific Island Birds: Biodiversity Meets Zooarchaeology. *Science* 267:1123–1130.

Stevens, Charles J.
1996 The Political Ecology of a Tongan Village. Ph.D. dissertation, University of Arizona, Tucson.

Thurston, David
1992 *Sustainable Practices for Plant Disease Management in Tropical Farming Systems.* Boulder, Colo.: Westview Press.

Wilson, Edward O.
1992 *The Diversity of Life.* Cambridge: Harvard University Press.

Worster, Donald
1990 The Ecology of Order and Chaos. *Environmental History Review* 14 (1–2): 1–18.