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Time, Complexity, and Historical Ecology

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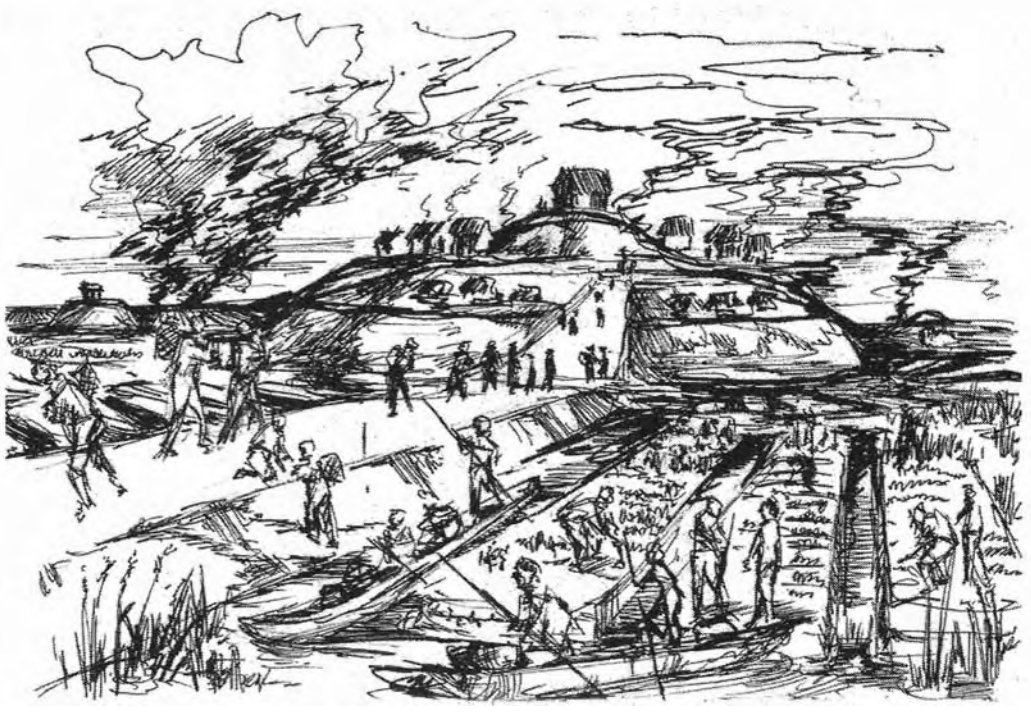
Edited by William Balée and Clark L. Erickson

TIME AND COMPLEXITY IN HISTORICAL ECOLOGY

STUDIES IN THE NEOTROPICAL LOWLANDS



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TIME, COMPLEXITY, AND HISTORICAL ECOLOGY

WILLIAM BALÉE AND CLARK L. ERICKSON

THE PERSPECTIVE OF HISTORICAL ECOLOGY

HISTORICAL ECOLOGY IS a powerful perspective for understanding the complex historical relationship between human beings and the biosphere. The present volume proceeds from the axiom that humanity in its historic paths across earth has interceded in material and measurable ways in a biotic world that evolved previously by natural selection and other evolutionary forces, and that the changes thus imposed on nature have in turn been reflected in human cultures, societies, and languages through time. In effect, historical ecology encompasses the view that wherever humans have trodden, the natural environment is somehow different, sometimes in barely perceptible ways, sometimes in dramatic ways. The authors in this volume have been trained in various disciplines, including anthropology (especially the subdisciplines of archaeology and sociocultural anthropology), geography, plant genetics, integrative biology, and general ecology, and they recognize the interdependence of these fields in attempting to comprehend the effects and countereffects of human behavior in the lowlands of the New World Tropics (Neotropics). The Neotropics are the torrid zone of the New World, and the lowlands within them are tropical in climate, moist, usually heavily forested, and at altitudes below approximately 500 meters. As shown in this volume's case studies, the neotropical lowlands exhibit classic anthropogenic or cultural landscapes formed over thousands of years.

Historical ecology is an interdisciplinary approach. It focuses on the historical *landscape,* a multidimensional physical entity that has both spatial and temporal characteristics and has been modified by human activity such that human intentions and actions can be inferred, if not read as material culture, from it.

The landscape is like a text, but not one that is readily accessible to historians' and epigraphers' methods because it is not written in a decipherable script, but rather is inscribed in a subtle, physical sense by learned, patterned behavior and action—what anthropologists traditionally refer to as *culture.* Culture is physically embedded and inscribed in the landscape as nonrandom patterning, often a palimpsest of continuous and discontinuous inhabitation by past and present peoples. In contrast to text-based approaches, the historical perspective taken by practitioners of historical ecology also includes prehistory. This version of historical ecology is explicitly people centered or *anthropocentric,* in contrast to other human-environmental approaches that tend to reify extrahuman and noncultural phenomena, such as natural selection, kin selection, self-organization, climate change in prehistory, ecosystemic change in prehistory, and ongoing randomness of pattern and event in the environment (Botkin 1990; Egan and Howell 2001a, 2001b; Gunn 1994; Kohler and Gumerman 2000; Winterhalder 1994). Our historical ecology also stands in sharp contrast to the neoenvironmental determinism popular in archaeology today (deMenocal 2001; Fagan 1999, 2000; Kolata 1996, 2002; McIntosh, Tainter, and McIntosh 2000).

As such, landscape ecology, which has been practiced almost exclusively by population ecologists, biologists, and conservationists, is not the same as historical ecology because landscape ecology has distinguished between landscapes without human influence (a modern version of the allegedly pristine environment, or what William Denevan [1992] aptly describes as the "pristine myth") and landscapes with human influence, usually assumed to be degraded or simplified (Alvard 1995; Alvard and Kuznar 2001; Chew 2001; Krech 1999; Redford 1991, Redford and Stearman 1993; Redman 1999; Soulé and Lease 1995; Stearman and Redford 1992). Historical ecology does not treat humans as simply another animal in a complex web of organisms, or as one species among many in an ecosystem understood within a system based on equilibrium and process. Rather, the human species can be understood as a "keystone" species (Mann 2002) and as a mechanism of environmental dynamics principally through disturbance (Balée 1998b), which sometimes enhances species diversity and landscape richness (Botkin 1990; Connell 1978).

In the perspective of historical ecology, natural environments, once modified by humans, may never regenerate themselves as such. The product of the collision between nature and culture, wherever it has occurred, is a landscape, the central object of analysis in historical ecology. Archaeologist and historical ecologist Carole Crumley points out that "historical ecology traces the ongoing dialectical relations between human acts and acts of nature, made manifest in the *landscape.* Practices are maintained or modified, decisions are made, and ideas are given shape; a landscape retains the physical evidence of these mental activities" (1994a:9, emphasis in original). The landscape is where people and the environment can be seen as a totality—that is, as a multiscalar, diachronic,

and holistic unit of study and analysis. In historical ecology, the anthropogenic landscape is a form of the built environment, often having been intentionally designed as architecture or as some other symbolic appropriation of nature that has patterned, physical underpinnings.

In this sense, human agency is expressed as intentionality in resource management (Balée 2003; Posey 2002); sophisticated strategies of land use (Erickson 2000b, 2003), and structured productive activities within the landscape (Heckenberger et al. 2003). The physical record of intentionality is key to understanding interrelationships between human society and its biotic environs over multiple temporal and spatial scales. The authors of the case studies in this volume and of other works in historical ecology and allied viewpoints (Balée 1998a; Cormier 2003; Crumley 1994b, 1998; Egan and Howells 2001; Ellen, Parkes, and Bicker 2000; Fairhead and Leach 1996; Lentz 2000; Li 1999; Zimmerer and Young 1998) present the evidence for the contemporary, historical, and archaeological centrality of these concepts.

Historical ecology is probably not a paradigm in the sense provided by Thomas Kuhn (1970), who doubted that such paradigms occur at all in the social sciences. Paradigms require overwhelming consensus in the scientific community, and all essential problems in the field (in this case, research problems concerning long-term relations between humans and the environment) need to have their own models of explication and deduction generated from the paradigm in order to have validity. Such consensus does not yet exist with regard to historical ecology, nor has historical ecology yet developed a wide range of models. Various authors have employed the term *historical ecology* to emphasize climatic change, geomorphological processes, environmental history, value of historical documents, and human ecology (Biersack 1999; Egan and Howells 2001; Gunn 1994; Moran 2000; Rival 2002; Sugden and Stone 2001).

Some of this confusion regarding the meaning of *historical ecology* seems to be an initial reaction to what we consider to be a radically new idea—namely, that humans can and have at different times and places increased the richness and equitability of nature by enhancing biodiversity (especially *alpha diversity,* or diversity in a restricted locale), soil fertility, and landform heterogeneity (in this volume, see chapters 1, 5, 7, 9, and 10). Humans can also decrease richness and equitability, but that is not a new observation (see Kirch and Hunt 1997; Orlove and Brush 1996). Scholars who subscribe to historical ecology as we define it in this book have tended to reject the assumptions of earlier approaches—such as cultural ecology,[1] human ecology, systems theory, and systems ecology—in proposing this perspective on human relationships with the environment over time. Historical ecologists disclaim the adaptationist assumptions of cultural ecology (and its congeneric modeling systems, such as behavioral ecology, systems ecology, self-organizing systems, sociobiology, and cultural materialism) (Diamond 1997; Harris 1979; Kohler and Gumerman 2000; Lansing 2003;

Meggers 1996, 2001; Smith and Winterhalder 1992). Adams lumps these various approaches, which for him are ultimately deriving from the cultural ecology of Julian Steward, under the term *etic rationalism:* specifically, one axiomatic part of cultural ecology that is repudiated in historical ecology concerns the concept of adaptation, whereby cultures "must first and foremost adapt themselves to the resources and opportunities of their particular environments, and this is the main explanation … for conspicuous differences between one culture and another" (1998:66). In the Amazon region, the adaptationist model has been referred to as the "standard" model (Stahl 2002; Viveiros de Castro 1996), and it still has its defenders (Headland 1997; Meggers 2001; Moran 1993). Likewise, systems ecology considers the environment and its physical constraints on organisms, their food supplies, and their populations to be hegemonic, self-sustaining, self-organizing entities. Ecosystem ecologists do not envision the ideal environment as intrinsically subject to long-term, sometimes profound change by individual organisms, particularly through the associated technologies and environmental know-how of human societies, except where those changes produce significant degradation and biological simplification of the previously existing environment (Moran 1990; Rappaport 2000). Conservation biology likewise corresponds to these sets of theoretical understandings with the added proviso that human activity in the environment is destructive (Pullin 2002; Soulé and Orians 2001). The concepts of the ecosystem, systems ecology, and cultural ecology ultimately tend to deny human agency in positively shaping the environment over time (Kohler and Gumerman 2000; Lansing 2003; Moran 1990, 2000).

Research in historical ecology instead focuses on how human societies, instead of adapting their subsistence activities, seasonal schedules, population size, settlements, and so on to preexisting constraints in the environment (Meggers 1996, 2001; Gross 1975; Harris 1979; see also critiques in Heckenberger, Petersen, and Neves 1999; Heckenberger et al. 2003; Stahl 1996, 2002; and in Clements, chapter 6, and Erickson, chapter 8, this volume), begin at once to transform most of those constraints into negligible analytic phenomena as concern suites of species, their alpha diversity, and other significant environmental features, as well as the availability of these resources for human utilization and modification within what demonstrably have become constructed and managed landscapes. In other words, environments are in a sense adapted to the sociocultural and political systems (or to humans' needs and desires) that have coexisted with them, sometimes for long periods of historical time. Historical ecology is not the same as landscape ecology (cf. Moran 2000:69). That is, historical ecologists disavow the view that humans are essentially automatons in terms of their exploitative and acquisitive activities in their physical environs (Kirch and Hunt 1997); they understand this view to be a fallacy implicit in models deriving from sociobiology, behavioral ecology, evolutionary psychology, cultural ecology,

and systems ecology. In observing human behavior within such a framework, ethnographers need not a priori ask natives specific questions about environmental phenomena because natives' discourse on their intentionality and their behavior vis-à-vis the environment is typically seen by ethnographers as *emic,* or nonscientific. At the same time, their scientifically observable, or *etic,* behaviors are assumed to be already selected for, either by a cultural or naturalistic mechanism (Durham 1991; Harris 1979; Rindos 1984) and are seen as economically rational and environmentally "sound" (see Adams 1998:338).

Historical ecologists seek to liberate scientific inquiry into human/nature relationships from these assumptions not only by incorporating the observable effects of human activity and resource management into the very definition of the landscape, but also by admitting that the central species in this ongoing relationship is endowed with unique and formidable cognitive, intellectual, and aesthetic ability as well as with inimitable agency in terms of environmental resources and productive strategies. Popular print and film media have recently picked up on this idea (Mann 2002; Sington 2002). Historical ecologists support a version of cultural determinism, at least for more extreme cases, of long-term creation and maintenance of engineered landscapes in the Americas (Balée 1989; Denevan 2001; Doolittle 2002; Erickson 2000b, forthcoming; Raffles 2002; Stahl 1996, 2002; Viveiros de Castro 1996; Whitmore and Turner 2002).

Perhaps a better philosophical guideline is to consider historical ecology as a research program (Lakatos 1980). The natural sciences have mechanisms for comprehending change in the environment, such as the laws of thermodynamics, relativity, and natural selection. Evolutionary ecology (also known as behavioral ecology) contains proposals of an interdependence of human genes and environmental conditions and constraints (e.g., Smith and Winterhalder 1992), whereas coevolution (Rindos 1984) exhibits a focus on an assumed interdependence of human genes and specific cultural phenomena. In contrast to historical ecologists, supporters of both approaches tend to deny human agency in the environmental milieus that encompass known societies. There is no need for consciousness of action or intentionality, moreover, in these models. Natural selection explains the evolution of species, whereas the social sciences only approximate such a mechanism by focusing on historical events, their chronology, and retrodiction (not prediction) of the motivating forces of history.

What historical ecology harbors as an explicit proposal is that *the human species is itself a principal mechanism of change in the natural world, a mechanism qualitatively as significant as natural selection.* In addition, the human species is not just a product of natural selection (though it is partly that) because it too makes histories and specific landscapes that bear its inscriptions. The cumulative effects of these undertakings influence the development and form of the exact cultural qualities of contemporary landscapes and are manifested in them.

Each major environment of the earth has a unique and often complex human history embedded in the local and regional landscape. Understanding the human role in the creation and maintenance of this uniqueness is a central goal of historical ecology. This approach involves the study of human effects on other life-forms, wherever they exist; historic changes in cultures due to these effects; and continuing (i.e., ethnographically documented) human effects on nature, sometimes in ways that increase the complexity and heterogeneity of the landscape through phenomena such as enhanced soils (Hecht 2003; Hecht and Posey 1989; Lehmann et al. 2003; McCann, Woods, and Meyer 2001; WinklerPrins 2001; Woods and McCann 1999), hydrology (Erickson, chapter 8, this volume; Raffles 2002), and species composition (Balée 1998b; see also Stahl, chapter 4, and Erickson and Balée, chapter 7, this volume).

Historical ecology is associated with some of the tenets of the new ecology (Botkin 1990; Little 1999; Scoones 1999; Zimmerer 1994; Zimmerer and Young 1999) such as "non-equilibrium dynamics, spatial and temporal variation, complexity, and uncertainty" (Scoones 1999:479). It does not brandish the *ecosystem concept* (cf. Moran 1990, 2000; Rappaport 2000) because that term has historically corresponded to synchronic views of arbitrarily defined spatial units that lack historical contingency (that are, in other words, in a supposed state of equilibrium). Practitioners of the new ecology also reject the ecosystem concept's equilibrium assumption (Begon, Harper, and Townsend [1990] and Botkin [1990] refer to landscapes as "culturalized ecosystems"; see also Worster 1994:390–391; cf. Egan and Howell 2001b:2). In fact, landscapes represent histories that unfold in a biotic and cultural domain in which inscriptions of an array of human activities across the temporal spectrum may be discerned by research. Historical ecology undertakes to present a historical (human and cultural) accounting of seemingly naturalistic events and processes, as with other contingency-based approaches to human-environmental dynamics (Prigogine and Stengers 1984). But it is not environmental history (Balée 1998b; Moran 2000; Worster 1993) because environmental history, like human ecology or ecological anthropology, is a subject field, whereas historical ecology actually instantiates a distinctive perspective on such fields.

Intentional and unintentional human activities can create—in addition to documented cases of environmental degradation—sustained levels of environmental disturbance considered important for ensuring resilience of biotas and landscapes (Connell 1978; Scoones 1999; Stahl 1996, 2000; Zimmerer 1994; Zimmerer and Young 1998). Nonequilibrium ecology is actually part of historical ecology. Historical ecology does not ignore catastrophic, chaotic disturbances that destroy (rather than merely alter) landscapes (Kirch and Hunt 1997). It emphasizes human activities in the environment over long periods of time that ultimately contribute to understanding the heterogeneity of landscapes across world regions, and it assesses the historical relationship among cultural, linguistic, and biological diversity (Maffi 2001).

OVERVIEW

Patterns of residues, anomalies, and cultural imprints (as palimpsest) of humans on the landscape are the primary data of historical ecology. In this book, these data include the genetics of plants and animals, especially those of semidomesticates within domesticated species; the geographical distribution of domesticates; biodiversity; agrodiversity; linguistic terms, narrative, oral history, and memory relating to the environment; agroforestry; fire histories; material culture; archaeological sites and settlement patterns; agricultural fields; anthropogenic soils; hydraulic engineering; archaeological and agronomic experimentation; and, finally, relations with domesticated animals.

Historical ecology recognizes two kinds of selection: one historical and the other properly evolutionary. One is not simply a variety of the other, yet in particular cases both are intertwined and analytically inseparable. In the case of the three sites in the Petén forest of lowland Guatemala studied by David Campbell and his collaborators in chapter 1, the diversity and patterning of vegetation cannot be understood apart from activities of the Maya people and their predecessors dating back at least 4,000 years. These people actively selected for economic species, and this suite of economically important plants can still be discerned in the present landscape as oligarchic forests, which by definition are dominated by just a few species and are often the result of human activity (Peters 2000). Indeed, the Maya landscape is incomprehensible without knowing this complex history and prehistory, in which humans are and have been the principal actors. The Maya landscape studied by Campbell and colleagues is highly patterned and cannot be described or understood without consideration of the human imprint inscribed on it.

As shown in the case studies of various chapters in the volume, history and prehistory are necessary to understand present-day landscapes. One can identify domestication of plants and animals, the introduction of these species into exotic habitats, and the effects such introductions have or have not had on local cultures, as Christine Hastorf examines (chapter 3). Elizabeth Graham (chapter 2) suggests that prehistoric peoples altered texture and chemical composition of natural soils, wittingly or not, not only in Amazonia, but in other neotropical regions; such human interventions in the ground had enhancing effects on soil fertility, which improved the results of agriculture. Graham also argues that local historical context and processes must be considered in order to understand the phenomena of dark earths recognized in many parts of the Neotropics. One can indicate how landscapes in eastern Bolivia have in effect been domesticated through engineering by rearranging soils, altering drainage, constructing massive earthworks, and enhancing effects on local diversity, as Erickson and Balée (chapter 7) and Erickson (chapter 8) demonstrate. Peter Stahl (chapter 4) documents in lowland Ecuador the heterogeneity of fauna in

a local habitat thanks to human agricultural activity over time. Charles Clement (chapter 6) demonstrates how the long-term domestication of fruit trees from the beginning of the Holocene period onward appears to be direct evidence for how and when people in the Amazon became early managers, as opposed to merely foragers of the forest. Michael Heckenberger (chapter 10) highlights the continuities and disjunctures in the ethnographic, historical, and archaeological record in south-central Amazonia regarding a demonstrably complex social and political organization of society in what has traditionally been considered an unpromising environment for human development. Loretta Cormier (chapter 11) examines the trajectory of a foraging society, the Guajá of eastern Amazonian Brazil, and discusses how their subsistence in recent times—as hunter-gatherers, that is, people without agriculture—can be explained only through consideration of a historical dimension that in turn incorporates a notion of variably weighted disruptions of contact (including disease, depopulation, and slavery) and of temporal vagaries in the landscapes their forebears inhabited. Eduardo Brondízio (chapter 12) explores how conceptual models that focus either on negative or positive effects of urbanization in Amazonian environments are inadequate for understanding the intrinsic complexity of the interrelationships among biophysical, sociocultural, economic, and historical factors actively influencing contemporary land use.

Merely listing the effects that indigenous peoples have had on nature over time fails to capture the diverse forms of manipulation and transformation of lowland neotropical environments documented to a noticeable extent within the chapters of this volume. As the case studies presented in this volume and in others demonstrate, some neotropical landscapes were created by native people organized as "complex" hierarchical societies (the states of the Maya and Olmec; the chiefdoms of the eastern Bolivian Amazon and upper Xingu River; and the major polities along the Amazon River in late prehistory [Carneiro 1995; Heckenberger et al. 2003; Neves and Peterson, chapter 9, this volume]). Countless societies historically considered to be "simple" in terms of sociopolitical organization (egalitarian bands and autonomous villages such as the Sirionó, Ka'apor, Guajá, modern Xinguanos, and other peoples discussed in this volume and elsewhere) have also had measurable effects on their environments (Balée 1989; Heckenberger et al. 2003; Posey 2002). All of these societies and others like them contributed to the complex and long history of how the contemporary environment came to be through their activities in the living landscape, measurable by material evidence. These activities were driven, moreover, at least partly by human intentions.

Intentionality with regard to living resources is conditioned by time and the complexity of the landscape. It is a facet of knowledge relating to the biosphere or some part of it. Historical ecology of knowledge reveals the means by which changes in the environment induced by humans actually condition

subsequent generations in terms of language, technology, and culture. Patterns of folk classification and the social constructs of nature, whereby some of the visible biota and landscape features of an environment have more psychological saliency than do others for a given group of people participating in shared knowledge of that environment, are molded by landscape transformation over time. Each such repertoire of landscape knowledge instantiates an ecological *epistéme* (cf. Descola 1996:93), a distinctive and historically defined way of knowing the environment that has its origins in the particular relationship it has had over time to local landscapes and to their metamorphosis at human hands. In other words, environmental knowledge is contingent on interactions people experience over time with their landscape (Ellen, Parkes, and Bicker 2000), and such an observed contingency is clearly not unique to the Neotropics (Ellen 1999; Fairhead and Leach 1996; Li 1999). That knowledge is not the result either of environmental (or biological) determinism or of cultural determinism alone (a point also made by Ingold 2000), but rather ensues from the conjunction of time and complexity in what is essentially a reciprocal dynamic between society and the environment.

Although human activities are assumed to have shaped the major environments of the earth, proponents of historical ecology are cautious about uncritically assigning the value-laden terms such as *beneficial, enhancing, sustainable, destructive,* and *degrading* to human activities past and present. These terms are often applied as black-box assumptions without clearly defining or considering the appropriate temporal or geographical scale of the case study. As Erickson stresses in chapter 8, these terms and their associated concepts imply an extant benchmark for a pristine, natural environment to which anthropogenic landscapes can be compared. As highlighted in the various case studies of this volume, however, pristine environments must be first proved, rather than assumed, in the Neotropics.

Conservation biologists have pointed to human-caused degradation of the environment such as predation (overhunting) leading to trophic cascades, anthropogenic eutrophication, air and water pollution, introduction of exotic species into new habitats, devastation by fire, habitat destruction and fragmentation, and extinctions 100 to 1,000 times the background rate (Pullin 2002; Soulé and Orians 2001; Wilson 1992). Historical ecologists maintain that human nature per se is not the culprit in these calamities; rather, causality can be addressed to historically defined configurations of interrelationships over time between specific societies and their economies, on the one hand, and given environments, on the other (Balée 1998b; Egan and Howell 2001a, 2001b). They maintain this view because in other cases of the human-environmental relationship, as documented in the Neotropics, local biodiversity (biological diversity as indicated by numbers and distribution of species of animals and plants, including agrodiversity) has increased thanks to human modifications and management of

resources and the landscape (Balée 1994; Berkes 1999; Brookfield et al. 2002; Denevan and Padoch 1988; Posey 2002; Posey and Balée 1989; various chapters in this volume).

Likewise, under certain agricultural and agroeconomic regimes, soils have become organically and chemically impoverished (such as loss of topsoil in the North American Midwest due to industrial agriculture, or salinization of the Euphrates River due to ancient Mesopotamian irrigation), whereas under other regimes, soils have actually become highly fertile in terms of their nutrient content and physicochemical properties. The organic black and brown earths of upland Amazonia (Amazonian Dark Earths), typically the result of prehistoric agriculture and settlement, are actually much more fertile than surrounding soils not so utilized and subjected to management over time (Erickson 2003; Hecht 2003; Hecht and Posey 1989; Lehmann et al. 2003; McCann, Woods, and Meyer 2001; WinklerPrins 2001; Woods and McCann 1999; see also Denevan, chapter 5, Erickson and Balée, chapter 7, and Heckenberger, chapter 10, this volume).

Indeed, the chapters in this volume taken as a whole constitute powerful evidence that *Homo sapiens,* as an agent of landscape creation, modification, and artificial selection over the long term, is synonymous neither with the ecologically noble savage (*Homo ecologicus,* the idealized human species that is inherently custodial and nurturing of nonhuman nature) nor with the ecologically ignoble savage (*Homo devastans,* the idealized human species that is biologically programmed to destroy nonhuman nature). The authors agree that indigenous societies in the Neotropics have permanently and significantly transformed, built, and maintained environments to such a scale that they have determined local and regional species diversity, environmental richness in general, soil quality, and other palpably natural features that are often the object of modern conservationist efforts. In the specific areas studied by William Denevan (central and lower Amazon regions, chapter 5) and by Eduardo Góes Neves and James Peterson (the central Amazon, chapter 9), the black earths point unmistakably to humans' intentional, long-term, custodial influence on the environment, even under regimes of intensive agriculture that would have been feeding and supporting dense populations. The topographically diverse raised field and fish weir landscapes in the Bolivian Amazon described by Erickson (chapter 8) enhanced ecological heterogeneity and created conditions for a higher standard of living for the prehistoric human inhabitants.

Conservation biologists and historical ecologists are concerned with habitat degradation and species extinctions. Regarding the human capacity for both landscape degradation and enhancement, we lean more toward the "enhancement" side and have an admittedly anthropocentric bias. Historical ecology demonstrates numerous cases of human activities that by conservation standards actually have benefited biological richness and diversity. Forests are typically

more species rich than adjacent savannas and grasslands per unit area. Fire has certainly been involved in destructive deforestation in Amazonia and other tropical regions worldwide (Pullin 2002:55), where savanna has expanded at the expense of forest and in some cases desertification has occurred. But Stephen Pyne (1998) has shown how North American Indians prehistorically used fire to manage forested and savanna landscapes actively. One outcome of such management by fire was to lower the risk of destructive wildfires of the sort that occurred frequently in the late twentieth century and are occurring in the early twenty-first century in the western United States and southeastern Australia. In other words, fire can certainly be damaging to a landscape and its attendant biota, and conservation biologists tend to focus exclusively on this damage, but fire can also be harnessed and used to enhance the diversity of the same.

Forest islands in the savannas of Guinea (West Africa) are now understood not to be relics of Pleistocene events or the remnants of once vast pristine forests, but rather direct and inescapable outgrowths of multiple generations of human settlement and intense resource management (Fairhead and Leach 1996; Leach and Mearns 1996). Forest islands in the upland savannas of central Brazil are likewise seen as anthropogenic, thanks to the activities of the Kayapó Indians (Anderson and Posey 1989; Posey 2002), although this view is still controversial (Balée 2003; Parker 1992; Posey 1992). Many if not most of the forest islands on the wet savanna of the Bolivian Amazon are now understood to be the result of settlement, farming, and mound building by its pre-Columbian inhabitants (Erickson 1995; Mann 2000; Walker 2003; see also Erickson and Balée, chapter 7, and Erickson, chapter 8, this volume). The savannas of the same region, which account for at least two-thirds of the total area, as Erickson reports in chapter 8, can be comprehended only as effects of intense human landscape management in the past. In cases of forest expansion and diversification directed by humans—that is, cultural forests (chapters 1, 5, 6, 9, and 10)—local biodiversity cannot be fully accounted for by using only a model of natural selection, but rather should be seen as artificially established by cultural conventions acting in tandem with given genotypes. In other words, through the study of traditional resource management and environmental knowledge in the past and present, we can begin to grapple with the implications of such knowledge for conservation and management of biodiversity and landscape diversity. The human activity that built earthworks, engineered soils and water, and constructed forests and savannas where there were none was more a product of human history than a result of evolutionary forces, such as natural selection (see Graham, chapter 2). The various species present on the forest islands of eastern Bolivia, West Africa, and central Brazil, which are biologically richer than the surrounding savannas, are likewise products both of natural and artificial selection acting in tandem, not in isolation. The formation of forest islands by human activity is one of the most dramatic examples of landscape research in

historical ecology; many other less dramatic but equally intriguing examples of the dialogue between humans and nature can be noted.

Historical ecology represents a range of studies that permit comparison among diverse sociopolitical entities in relationship to local landscapes, larger phenomena such as regions, and ultimately the biosphere itself. In this volume, we present a range of studies as they relate specifically to the lowland Neotropics, an arbitrary geographical designation to be sure, but one with intrinsically well-documented cases of extensive resource and landscape management by humans over many millennia and across a tremendous array of habitats, environments, and distribution patterns of flora and fauna. Each lowland neotropical landscape presents us with a rich history of human activities, the effects of which in principle can be evaluated on their merits and not a priori presumed to be either conservationist or anticonservationist in character. Historical ecology applies a multiscalar geographical (local place to regional landscape) and temporal (short- to long-term) perspective for a historical understanding of human activities in the environment and how the environment itself came to be. As a consequence, historical ecology may provide practical strategies for managing landscapes in the present and future.

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NOTES

1. The term *cultural ecology* has long been used somewhat differently in geography; it does not refer so much to a point of view as to the subject matter of interactions between humans and the environment (Wagner and Mikesell 1962). We use the term here in the original sense of Julian Steward to indicate a perspective that assigns determinism of social and ideological phenomena to technology and the environment.

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