Historical Archaeology and the Environment: A North American Perspective

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Introduction

Environment plays an uncertain, variable, and sometimes contradictory role as an explanatory concept in historical archaeology. In this, historical archaeology is not unique. Crumley (1994:2), for example, observes that in the typical introduction to anthropology course or textbook, the environment plays an enormous role in interpreting the early history of human evolution but that "midway through the text or term, the environment no longer figures in the narrative except as a resource to be commoditized." Yet, by the end of the course, Crumley (1994:3) goes on to observe,

> the lecturer or author takes up the single most pressing issue: rapid global environmental change at the hands of the human species. The environment, marginalized in the latter portions of the story of human evolution, becomes again the central problem for the species. To claim an integrative, holistic, and dynamic approach to human environment relations, anthropology must transcend this fundamental contradiction.

The contradiction is reflected in history as well. Social historians typically marginalize the environment as a significant player in interpretation, but environmental historians focus upon environmental issues as a key problem area. That the two approaches can be combined effectively, however, is clearly illustrated in Alan Taylor's (1995) wonderful study of William Cooper's Town. Toward this end, he argues persuasively that "social history is environmental history just as environmental history must be social history" (Taylor, 1996:16), and, citing Arthur McEvoy and Donald Worster, that "because our environmental crisis and worsening social inequalities are interdependent, neither problem can be alleviated without attention to the other. Sustaining a relationship with the natural depends on a greater equality in the social benefits and costs of its consumption" (Taylor, 1996:16).

As might be expected, historical archaeology, which by definition is not concerned with the early history of the human species and limits itself to the study of the modern world, often marginalizes environment in its explanations of human diversity and change. Environment, however, has not been completely ignored, and this chapter provides some primarily North American examples. Deagan's (1996) excellent overview of environmental studies in historical archaeology shows that practitioners of the discipline typically have approached issues of human–environmental relationships from the perspective of the world systems paradigm and a market economy, especially that driven by the capitalism. Certainly the global scale of historical archaeology is ideally suited for grasping the significant environmental issues of the modern world. Several years ago, an international conference "Ecology and Empire: the Environmental History of Settler Societies," for example, pointed to issues in the global ecology of the modern world as an interdisciplinary context within which a more environmentally aware historical archaeology can emerge (Griffiths and Robin, 1998). Conferees discussed such topics as deforestation, fire, ecological science, commerce and commoditization, and specific aspects of the colonial environmental

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experience in Australia and South Africa. Archaeological data from historical sites can be brought to bear on all of these issues, as exemplified by the emergence of a global-change archaeology within the last few years (e.g., Crumley and Hornborg, 2006; Hardesty, 2007; McIntosh et al., 2000; Redman et al., 2004; Rockman and Steele, 2003).

Urban archaeology is another possible focus of an historical archaeology that is informed by contemporary environmental issues and problems. Deagan (1996:370–371), for example, points to the long-term study of New England's urban landscapes conducted by Stephen Mrozowski, Mary Beaudry, and their colleagues:

> Combined analyses of pollen, plant macrofossils, archaeological features, and archival data from several New England settlements resulted in a characterization of emergent and established urban landscapes. Early urban centers contained residential household gardens characterized by dry, disturbed soils, weedy plant species, exotic weeds, and edible plants within densely settled areas. As cities grew and land use became more intensive, residential areas were segregated in suburbs with households and yards not used for food gardens and other economic activities.

Grimm et al. (2000) offer a similar perspective on a modern urban place in the American Southwest. How to most effectively integrate environment into the research agenda of historical archaeology, however, is a problem. The concept of environment means very different things within the context of natural science, social science, and humanistic structures of inquiry. As a social science, for example, historical archaeology pursues "social constructions" of nature (e.g., Hannigan, 1995). As humanistic inquiry, however, historical archaeology operates within a structure of inquiry intended to write histories of the "transformation of nature into culture," interpreting environmental meaning within a social and cultural context. In a recent paper, Mrozowski (2006) demonstrates how a biologically oriented historical archaeology can contribute to a fuller understanding of the biological dimensions of cultural processes such as colonization, urbanization, and industrialization. In the remainder of this chapter, I develop these ideas further and explore the usefulness of several alternative structures of environmental inquiry to historical archaeology.

Processual Paradigms

One general approach to the use of environment to explain variability and change in human behavior is explicitly scientific and interprets interplay between the human organism and its environment with general processes. Of these approaches, some are "monistic," assuming that the same processes affect all life forms, including the human organism, and others are "exceptionalist," treating humankind as unique. The most commonly used monistic paradigms are evolutionary ecology and systems ecology. Cultural ecology is the best-known exceptionalist paradigm.

Evolutionary Ecology

The Darwinian principle of natural selection is the cornerstone of evolutionary ecology. Processual models of this type hold in common the idea that human behavior is variable, that some of these variants are better than others at solving environmental problems, and that these adaptive variants are reproduced at the expense of those that are not. They also focus on the decisions that individuals make in selecting or rejecting environmental resources and work within the operational framework of microeconomics (see, for example, Smith, 1991). Schiffer (1996) observes that there are two approaches to evolutionary ecology in archaeology. One approach attempts to reconstruct the actual behaviors from the archaeological evidence of human activities. Behavioral models of this type might involve, for example, the reconstruction of the varieties of domestic households or local settlements and track differences in their persistence in time and space. The other approach, often called evolutionary archaeology (e.g., Leonard and Reed, 1993; O'Brien, 1996; Teltser, 1995), eschews reconstructing behavior in favor of what can be directly observed in the archaeological record, the artifacts themselves and their varieties as material expressions of an "extended phenotype" upon which selection operates. Here, evolution is simply the "differential persistence of discrete variants" (Schiffer, 1996:646).

Optimal-foraging models are the most commonly used ones in evolutionary ecology, but the

paradigm also includes life history, group formation, and community structure models (e.g., Smith, 1991:34). Smith (1991:41) describes optimal-foraging theory as "a general framework for explaining animal foraging behavior as a product of evolutionary design." It employs the same logical structure used in other optimization models, such as those used in microeconomics and in decision theory. The models portray actors making choices according to a strategy that optimizes some currency (e.g., calories or money) within a set of constraints. Optimal-foraging models attempt to identify general decision-making strategies that are applicable not only cross-culturally but also across species. Hardesty (1985) uses an optimal-foraging model to help understand the environmental decisions and movements of miners in the American West. The miners are conceptualized as "industrial foragers" who move from ore patch to ore patch according to the predictions of Charnov's marginal value theorem. Charnov's theorem states that "the optimal predator should stay in each patch until its rate of intake (the marginal value) drops to a level equal to the average of intake for the habitat" (Krebs and Davies, 1978:43). In Hardesty's application, ore patches on the American mining frontier are viewed as commodities with values that change within a global marketplace and with harvesting costs that vary with available technologies of transportation (e.g., railroads) and extraction (e.g., mechanized open pit mining). The model is capable of predicting patterns of ore patch abandonment and recolonization that could be tested with archaeological and documentary data.

For our purposes, life history models can be understood best as "archaeological ecobiographies" of individuals or small social groups such as families or domestic households (Hardesty and Fowler, 2001). They portray the historical trajectories of environmental movements and choices made by individuals or households during their lifetime. King (1993), for example, combines documentary, archaeological, and oral historical data in writing an ecobiography of an Alaskan miner during the early part of the twentieth century. Group formation and settlement pattern models focus upon environmental decision-making that affects the location and organization of settlements. Eric Smith's (1991) study of the settlement location decisions of contemporary Inujjuamiut foragers of Arctic Canada is a good example of the approach.

Community structure models, finally, are scenarios of environmental decision-making taking place within the social and cultural context of larger groups such as the community. Krannich et al. (1996:852), for example, use the concept of the "water user community" to understand the social impacts of severe and sustained drought in the Colorado River Basin:

> Water user communities are social networks, each of which is comprised of people who share a common, but limited, water resource. The living in and dependent upon an irrigation district that draws water from the Colorado River, for example, may define one type of community. Another community type may involve a group of people who are dependent upon the pumping of groundwater that is affected by a Basin-wide drought.

The concept of the human ecological niche (Hardesty, 1975, 1977) is used to analyze and interpret how different groups within a water user community, such as those defined by class, ethnicity, occupation, and gender, are impacted by long-term drought in the Colorado River Basin. Krannich et al. (1996:852) note that "[i]n this case, the niche is defined by a distinctive strategy for using a limited water supply; the strategy includes not only a lifestyle but also an underlying complex of ideologies, attitudes, values and beliefs about water." They conclude that "the social impacts of severe sustained drought in the Colorado River Basin, then, should be reflected by changes in the niche structure and other characteristics of the water user community" (Krannich et al. 1996:863). Schaffer and Schaffer (1984), for example, document changes in the social networks defining communities in the Ogallala Aquifer area of Texas that include migration, occupational shifts, social upheavals, group conflict, and disintegration.

Systems Ecology

Another monistic paradigm is systems ecology, which focuses not upon the processes that connect environment to individual species or populations but upon the processes operating at higher levels of biological organization such as the community and the ecosystem. Like evolutionary ecology, systems ecology assumes that all life forms, including

humankind, are affected by the same general processes. The cybernetic model is the hallmark of the systems ecology paradigm. Roy Rappaport's (1967) classic study of the Tsembaga Maring in highland New Guinea is the best-known application of the cybernetic model to human populations, but it has been widely used since then in anthropology and archaeology (e.g., Moran, 1990).

The cybernetic model, however, which presupposes that species live in balanced, integrated communities with well-defined boundaries in time and space, does not now appear to be a good representation of reality. Ecologists have found that self-regulating mechanisms that operate at the level of the ecosystem or community are insignificant. In general, "the principle of balance has been replaced with the principle of gradation—a continuum of degrees of human disturbance" (Soule 1995:143). Still, as discussed above in the "community" approach to evolutionary ecology, the concept of ecosystem or community is useful in understanding the interactions taking place among species or populations living in the same environment, whether that environment be a small pond, a mountain valley, or a global world-system. Landon (1995:9–10) argues for its use in historical archaeology, noting that the concept is capable of taking into account "decision-making individuals operating in a cultural and historical context" and that Hastorf (1990:132–134) sees the concept "as especially valuable for regional-scale, long-term analyses that open up the system to include the reflective actions of humans, and consider soil, climate, and the environment, without privileging the environment as the major instigator of change." The addition of a historical dimension to the concept of ecosystem, the removal of system-wide processes operating above the level of individuals, and a focus on landscapes as the material expression of ecosystem histories are, in fact, the key components of the historical ecology approach to be discussed below.

Cultural Ecology

Culture as the unique human means of adaptation to environmental constraints and opportunities is the focus of cultural ecology, a widely used environmental paradigm developed by the late Julian Steward and his intellectual descendants (e.g., Netting, 1993; Steward, 1955). The focus upon culture as an adaptive strategy for environmental problem-solving by human populations makes it distinct from competing monistic paradigms such as evolutionary ecology and systems ecology. Cultural ecology has been by far the most commonly used approach to environmental analysis in historical archaeology. Miller (1984, 1988), for example, uses the concept of cultural adaptation in explaining the evolution of subsistence strategies in the Chesapeake Bay region during the seventeenth and eighteenth centuries. The foodways of the first colonists were highly seasonal, diverse, and dependent upon wild animals and plants, a strategy that minimized risks in a new and unfamiliar environment. Later generations of colonists, however, shifted to a subsistence strategy that was less seasonal, less diverse, and more dependent upon domestic animals. Miller found that the Chesapeake Bay subsistence pattern had diverged significantly from its English historical antecedent by the early eighteenth century.

In practice, cultural ecology is a method of analysis intended to identify specific features in culture and in the environment that engaged in dialectical interplay. Those cultural features that did so formed a "culture core," which typically included those features that are "most closely related to subsistence activities and economic arrangements" (Steward, 1955:37). The culture core should reoccur in other places with the same environmental features. Steward incorporated environment into his theory of multilinear cultural evolution, holding environment constant and conducting comparative studies of cultural patterns. Cultural ecology explains the origin of cultural traits/patterns by showing that they occur cross-culturally in the same environment and that the occurrences are not historically connected. This approach, however, may not necessarily show that the relationship is causal (Vayda and Rappaport, 1968:483–487). Brumfiel (1992) further challenged cultural ecology as an explanatory paradigm in archaeology by arguing that cultures do not adapt. What adapts are "culturally based behavioral systems," in turn the "composite outcomes of negotiations between positioned social agents pursuing their goals under both ecological and

social constraints" (Brumfiel, 1992:551). She also objected to the use of whole populations as the unit of ecological analysis because it "obscure[s] the visibility of gender, class, and faction" (Brumfiel 1992:551). Toward this end, the late Robert Netting greatly refined the cultural ecology paradigm with his recent studies of the "smallholder household" as a type of culture core with cross-cultural and historical validity (Netting, 1993). The smallholder household is conceptualized as a culturally based behavioral strategy of adaptation organized around a small-scale social group. Likewise, Wilk's (1991) study of the Kekchi Maya household explores the sometimes contradictory roles of history and adaptation in household formation and evolution. Hardesty (1992) takes a similar approach to the comparative study of miner's households, combining archaeological, documentary, and ethnographic data to do so. In addition, the concept of cross-cultural types, a key concept in cultural ecology, may be useful in "tracking" the evolutionary trajectories of ecosystems in industrial cultures. Industrialization as an historical process transforms the landscape along a sequential series of "ecoindustrial types." Each type can be conceptualized as a distinctive set of ecological relations, including a system of meaning, power relations, social relations, relations of production and exchange, environmental opportunities, and constraints.

Historical Ecology

Most of us would agree that "archaeology is first and foremost an historical discipline, both historical science and humanistic history" (Hardesty and Fowler, 2001:78). The use of historical analogs in environmental studies, however, has not been forthcoming until quite recently. Some physical scientists, for example, reject historical analogs outright, arguing that unique "novel circumstances" such as twentieth-century chemicals or population explosions render historical analogs irrelevant. At the same time, historical analogs are becoming more and more acceptable as the cornerstone of environmental studies. Fire ecologist Stephen J. Pyne's (1995) fascinating book *World Fire: The Culture of Fire on Earth*, for example, takes an explicitly historical approach in understanding the role of fire in the development of regional biomes. Documenting the historical context of human–environmental interactions, therefore, would seem to be a central concern. The historical context of human–environmental interactions consists mostly of historical events (e.g., floods, fires, volcanic eruptions, introduction of exotic biota) and historical cycles (e.g., long-term regional and global climatic cycles, economic cycles). Such environmental histories may be coarse grained or fine grained. Coarse-grained histories are written at large time and space scales such as regions (e.g., the use of the concept of region in Crumley, 1987, 1994); fine-grained histories are written at small time and space scales such as the individual or household or local group.

As developed by Carole Crumley (1987, 1994, 2001) and others, historical ecology is an "actor-based" approach that focuses on the decisions and actions of "positioned social agents," that uses "historical analogs" to interpret human–environmental interplay, and that reads "landscapes" as the cumulative material expression of the historical trajectories. Historical ecologists use two types of historical analogs to explain environmental change. Nature analogs consider only acts of nature, comparing, for example, the global climate effects of large-scale volcanic eruptions like Krakatoa (A.D. 1883) and El Cichon (A.D. 1982) without reference to humankind. Dialectical human–nature analogs, on the other hand, consider the dialectical interaction between human acts and acts of nature. Volcanic eruptions such as Arizona's Sunset Crater (A.D. 1064), for example, induces a period of crop failures, which is offset by storage or social alliances in some areas but not in others (e.g., Sullivan and Downum, 1991). Another example is the environmental impact of introducing exotic plant and animal species into an indigenous biota such as North America (e.g., Deagan, 1996) or the Hawaiian Islands (e.g., Kirch and Hunt, 1997; Kirch and Sahlins, 1992). In this regard, Kirch (1997) makes the convincing argument that islands are natural laboratories for controlled comparative studies of global environmental change. Yet another example is the social and biological stress on the Jamestown (Virginia) colony brought about by a drought episode from 1607 to 1612 (Blanton, 2000).

The dialectical human–nature model of historical analogs uses the concept of landscape to study environmental changes over a long time span and tracks such changes with an interdisciplinary approach (e.g., Cassell, 2005; Lozny, 2006; Metheny, 2006; Rockman and Steele, 2003). Landscape archaeology in this sense combines physical data (e.g., modern climate, soils), documentary data (e.g., agricultural history, fire history), archaeological data (e.g., plant and animal remains), and ethnographic data (e.g., the observed use of fire by farmers). Teasing out the relationship between environmental history and landscape, however, requires careful attention to the use of historically sensitive concepts with a landscape expression that can be explored through the archaeological record. They include, for example, measures of environmental variability and diversity in time and space such as patchiness and grain, persistence, and predictability (Winterhalder, 1994). Historical ecology also requires recognition that environmental events and processes operate on multiple time and space scales, resulting in shifting boundaries and organizational structures (Crumley, 1987, 1994).

Ecological Marxism

Another historical paradigm is Marxism, which has played an important role in the thinking of many historical archaeologists (e.g., Leone et al., 1987; McGuire, 2002; Orser, 1988). Marxist scholars, however, generally have been skeptical of ecological issues and explanatory principles. Traditionally, Marxist scholars ignored issues of ecological sustainability, in some cases taking the position that the political ecology of the 1960s was nothing more than yet another ideological "mask" used by the dominant classes to obscure their self-interests. The blame placed on overpopulation as a cause of environmental problems, for example, focused on the Third World and ignored the overconsumption of the industrialized nations. The "greening" of Marxism in recent years has involved rethinking "infrastructure" to include the forces of nature or the "conditions" of production as well as the forces and relations of production (Benton, 1996). Contradictions between the forces and relations of production and the conditions of production are now recognized. The creation of an ecological Marxism has involved several changes. First of all, the key concepts of historical materialism, especially the capitalist mode of production, have been modified to explain ecological degradation and ecocrises (Benton, 1996:104). Several years ago, for example, Gunnar Skirbekk (1988) argued that the ecological crisis of the 1970s also could be explained as a contradiction of capitalism. The contradiction, however, contained within its infrastructure, included not only oppositions between the forces and relations of production, the traditional Marxist interpretation, but also oppositions between the forces of production and what he called the "conditions" of production or the forces of nature. From this view, the social transformation that necessarily ensues involves "a reconciliation not just between forces and relations of production, but also between these and the natural conditions of production or 'forces of nature'" (Benton, 1996:105). Marxist scholars continue to argue that this transformation must be a socialistic mode of production organized around central planning but now consider the possibility that this in itself will not guarantee an ecologically sound infrastructure, as is well evidenced by the ecologically disastrous political systems in the former Soviet Union.

Environmental Humanism

The final structure of environmental inquiry to be considered focuses on the archaeology of "meaning." Historical landscapes provide images of and information about the cognitive world as representations of environmental knowledge and as ideology. The fengshui landscapes associated with ethnic Chinese culture, for example, reflect the principles of geomancy to a greater or lesser degree (Wei, 1992; but see Greenwood, 1993). Renfrew and Zubrow (1994) argue that such cultural representations or systems of meaning can be approached not only archaeologically but also within a scientific structure of inquiry. Historical landscapes also represent ideology, which plays a prominent role in creating the social and political context and uses of knowledge (Leone et al., 1987:282). Most of all,

ideology is politically active and often serves the purposes of social groups or individuals. Thus, Leone (1984:26) comments that

> Ideology takes social relations and makes them appear to be resident in nature or history, which makes them apparently inevitable. So that the way space is divided and described, including the way architecture, alignments, and street plans are made to abide by astronomical rules, or the way gardens, paths, rows of trees, and vistas make a part of the earth's surface appear to be trained and under the management of individuals or classes with certain ability or learning, is ideology.

Such a "critical" approach to environmental meaning, however, has not gone without its detractors. Consider, for example, Soule's (1995) critique of deconstructionism as a structure of environmental inquiry. Soule (1995:137) observes that in recent years, deconstructionism has been widely used by social critics to

> question the premises that sustain the existing social order. And if those premises "priviledge" a particular group, and if that group has not struggled to achieve its status, or if the premises are "false," then it is essential to "deconstruct" these premises—to lay them bare by the dissection of analysis—because the exposure of premises increases the likelihood of change.

Deconstructing conceptions of nature and wilderness have become part of this style of social criticism, up to and including challenging the existence and essential reality of nature and wilderness.

The "myth of constructionism" brings together two levels of meaning from the deconstructionist critique of nature (Soule, 1995:148–155). First of all is the challenge to the premise that nature has an objective physical reality that is independent of the observer. Cultural biases and sensory filters operating on each individual observer distort reality so much that the "truth" of nature, certain knowledge, cannot be obtained. Rather, we have only "constructions" (biased reports or stories or narratives) of nature, not a reality. From this perspective, scientific reports are no more valid, and to be treated the same as, other "stories" about nature, whether they be folktales, sacred texts, or whatever. This is an extreme example of cultural relativity and historicism, denying that any aspect of nature is replicable cross-culturally or historically. Soule (1995:149) notes that

> The social objective of this movement is to demystify and dethrone the "hegemonic dominance" of science and replace it in the public's ranking of authority with a level field that does not privilege any single approach or give it the power to ignore competing representations made from other positions.

Secondly, whatever physical reality nature may have, constructionists claim that it is no longer "natural" but a "human artifact" created by a long history of economic manipulation by indigenous peoples. In response to such claims, Soule points to cross-cultural studies showing that people carrying different systems of cultural meaning do often perceive nature in the same way. Ethnobiologists, for example, have pointed to scientific and folk taxonomic classifications of plants and animals that are essentially the same. Soule also notes that while scientists certainly are biased and that such biases must be taken into account, that does not imply that "science" is. Science, in fact, is a self-correcting system of meaning with methods that not only identify errors but also allow their correction.

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