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## Articles

### Time in Service to Historical Ecology

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Historical Ecology is one of the ascendant views in ecological and environmental anthropology. It originates in the intellectual transformation of history and ecology during the last 50 years, and seeped into anthropology in the last 10 to 15 years. Historical Ecology is increasingly recognized as one of the key approaches in the discipline helping to advance our understanding of what it means to be human.

There are numerous definitions of historical ecology, but the anthropological challenge is to place human decision-making, and the consciousness that drives it, at the center of our analyses of the human-environmental relationship (Crumley 1994, Whitehead 1998, Whitney 1994). What this challenge entails is clear from a caricature of how the natural and social sciences view this relationship. In the natural sciences, humans are drivers of environmental change and there is little or no insight into the rationality behind any given transformation. In the social sciences, cognition and the resulting choices made by humans link them to their environment in a dialectical process of transformation. Humans as drivers of environmental change are nothing more than a problem to be disposed of; humans as co-producers with environment of the transformation offer the potential for altering the final outcome.

As is so often the case with emerging approaches there is debate as to whether historical ecology is a unified theoretical position or merely a research tool (Balée 1998, Whitehead 1998). However, it can be productive to consider a

different question emerging from our responsibility to manage Earth (Vitousek, Mooney, and Lubchenco 1997): How can anthropology participate in the collaborations needed to understand the neglected-to-engineered gradient of current environmental systems? Toward answering this question I first review the points of origin for historical ecology then examine how the essential properties of time can help center the practice of historical ecology on a *problem* and a *place*. The objective is to move historical ecology closer to addressing how past ecologies produce present ones in order to consider the future(s) we might pursue rather than simply let happen.

#### POINTS OF ORIGIN

All disciplines are continuously remodeled as practitioners push outward the boundaries of knowledge and improve their methods of inquiry. History by comparison to ecology is an old discipline, but historical ecology emerges from the relatively recent transformation of "old" history into "new" history and "reductionistic" ecology into "integrative" ecology. The revolution in the sense of Kuhn (1996) begins shortly after World War II and is completed by approximately 1980. In essence, history as a discipline came to recognize the importance of environment, and ecology as a discipline came to recognize the importance of history. Historical ecology as the convergence of new history and integrative ecology is increasingly practiced

across a diverse set of fields from zoology through anthropology.

### **New History**

Not more than 100 years ago, the established historical paradigm was to create narratives about the organization of power and authority from documentary sources and present them as testimony. As described by Fischer (1989: viii), “I have steeped myself in the sources, and here is what I believe to have happened,” and they were believed, for this was a time when scholars were gentlemen, and a gentleman was as good as his word.” The received paradigm began to unravel in the early 20th century as new interests emerged and inconsistencies were challenged. By the early 1960s, European and American scholars discovered the French School of *les Annales*.

*Les Annales* was a different kind of history. Rather than a story-telling craft about power elites in the past, it solved problems evident through the acts and thoughts of ordinary people. These acts were then shown as directly responsible for change across time. The goal of *Les Annales* was an *histoire totale*, a total history of the human experience (Braudel 2001). Its practitioners drew widely from documents, material culture, statistics and the mentalities or psychology of epochs to create an *imbricated* whole. The two fundamental assumptions of *Les Annales* are that structures are historical and constantly evolving, and there are no fortuitous event sequences in time (Fischer 1989). Results are presented as argument rather than testimony, and the historian is required to demonstrate the truth-value of statements by rigorous methods of logic and empiricism. The point is to reveal historical processes in the past and those of the future still in the making.

While empiricism improves on the intuitive interpretations that old history presented as testimony it often loses the compelling engagement of narrative. As such, some authors advocate melding the best of both – an approach referred to as narrative positivism (Abbott 2001). In practice, this is the first step of re-balancing specificity and context (Kolchin 2003). As an investigator gets geographically and temporally closer to a subject they more easily recognize complexity and variation; as they increase the distance to their subject, patterns common to a wide variety of situations become clearer.

Historical judgment in response to proximity and distance relate directly to the challenge of demonstrating any given past is immediate to the present making possible a given trajectory into the future. The question is how can historical knowledge help resolve major problems in distinct disciplines including anthropology and ecology?

### **New Ecology**

Ecology had to move from typology to function and from qualitative to quantitative description before the value of history was recognized. Like historians (and other social scientists), ecologists after World War II sought to formalize their ideas about nature and develop theories of general validity expressed in mathematical form. The concept of ecosystem and its single greatest advocate, Eugene Odum, were critical in moving ecology during this period from diverse and often conflictive fields of inquiry to the status of discipline (Golley 1993). The integration of ecology comes next and stems from the recognized need to join the two major schools of thought within ecology: ecosystem ecology and population ecology (Palladino 1991), colorfully referred to as stuff ecology and thing ecology (Pickett, Kolasa, and Jones 1994).

Eugene Odum and his brother Howard favored a cybernetic view of ecosystems as self-regulating units composed of functionally related parts (Odum 1953, Odum 1971). This was a holistic yet deterministic perspective with roots in organicist and technocratic ideologies (Taylor 1988). The view stood in sharp contrast to the probabilistic and stochastic perspective of population ecology directed at mathematically examining the stability properties of real and model systems (Roughgarden, May, and Levin 1989, Ulanowicz 1990). The pioneers of this approach began by testing the causal link between species diversity and community stability that ecosystem ecology advocated. In failing to verify its existence they shifted from the study of diversity-stability relationships to complexity-stability relationships (Pimm 1991).

The encounters between ecosystem and population ecology led to three fundamental outcomes that foster the growing recognition that ecology needs to integrate its two cultures (Holling 1998, Pickett, Kolasa, and Jones 1994). The first is the understanding of variability in

space and time and its concern with complexity, uncertainty and surprise (Holling 1973, Pickett and White 1985, Wiens 1976). The second is the scaling of dynamic processes and nonlinear interactions across hierarchies and heterarchies (Allen and Starr 1982, Ehrenreich, Crumley, and Levy 1995, Turner 1989). The third is the temporal dynamics of current patterns and processes challenging basic and deeply held assumptions of naturalness, balance, order and predictability (Carpenter and Gunderson 2001, Clark et al. 2001, Sprugel 1991). These outcomes have engendered novel ways of thinking about resource management and policy often rejected by more conventional perspectives. The use of history, including development and evolution, is explicitly recognized as necessary to the integration of ecosystem and population ecology (Pickett, Kolasa, and Jones 1994).

### **Historical Ecology**

Historical ecology has many meanings depending on the discipline, but when it comes to practice, it is clear that an organismal rather than a molecular focus is paramount. This focus tends to distance historical ecology from the practice of environmental history (a field it is often conflated with) and align it more closely with ecology. The reasons are both theoretical and practical. Theoretically, all traditional hierarchies in ecology intersect at least at the level of individual organisms and this has been suggested as the node to begin the integration of ecosystem and population ecology from (Pickett, Kolasa, and Jones 1994). Practically, history may be a rock, but the stories told by environmental historians provide little guidance in the whirlpool of prophecy (Cronon 1993) that decision-makers at all levels are asking social and ecological scientists for help with. Before addressing the properties of time, it is relevant to consider at least superficially two applications of historical ecology outside the social sciences.

Neo-Darwinism is a theory of how diverse factors in an organism's environment operate uniformly on random variation to produce historically contingent evolutionary change. Evolutionary ecology tries to answer this historical question using indirect estimates drawn from phylogeny, but observations on the fossil record alone fail to distinguish the inseparable

properties of evolutionary rate and historical time (Ehrlich and Raven 1964). Brooks (1985) demonstrates by example how species can be considered characters of the areas where they occur, as well as how species' lineages can be considered transformation series linking different areas in an historical pattern. His argument is that the topology of interactions for an ecological association represents the direct phylogenetic observation complementing the fossil record.

In population ecology, Christensen (1989) outlines the significance of what he terms landscape history for addressing the consequences of past events for the current structure and function of ecosystems. He notes that history was long ignored in population ecology by virtue of the forcefulness of Clement's theory of succession (Clements 1916, Tobey 1981). Late successional ecosystems were thought to contain little information about their history so that disturbance in the past was relatively unimportant for explaining current ecosystem composition. One of the most significant changes in the study of ecosystems in the last 30 years is the realization that environments are not static and that disturbances can have long-range ecological consequences lasting decades, centuries or even longer (e.g., Harding et al. 1998, Jones et al. 1999). The most compelling reason to study the effects of past disturbance on the current structure and function of ecosystems is the need to forecast future ecosystem changes and design approaches to managing it (e.g., Clark et al. 2001, Golodetz and Foster 1997, Swetnam, Allen, and Betancourt 1999).

The preoccupation with *what* happened in the past particularly in the second example was born from the contemporary interest in forecasting the future. However, answering the question of *why* events happened is a necessary prequel to designing public policies or management objectives. For example, ecologists may understand the effects of fire on forest ecosystems (e.g., Agee 1993) yet not know (or care) whether a fire event was started by lightning or humans using heavy equipment. The *why* cannot be answered as long as humans are effectively excluded from the study of "natural" systems by reducing their role to that of an external driver or by equating their role to that of another organism (e.g., human = deer). Bringing a human

dimension to historical ecology has been the focus of numerous social scientists in recent years. The essential properties of time and how they center the practice of historical ecology on a problem and place are fundamental to their efforts.

### ESSENTIAL PROPERTIES OF TIME

Time matters, but what does the concept of time embody? Karl Marx in his narrative about Louis Napoleon's coup d'État of December 1851 (Marx 1937), opens with a statement referencing Hegel that all great world-historic facts and personages appear twice. This brief statement embodies several essential properties about time, which once revealed demonstrate that only time that transcends chronology is truly productive to the historical ecology enterprise. It is important to first recognize four assumptions about time as used in science (modified after Abbott 1992, Lloyd 1994, Pera 1994, Ulanowicz 1990 and others):

Continuity Assumption: things happen in discrete, non-overlapping events of uniform duration.

Flow Assumption: when events of different durations must be invoked determinacy flows from a) long-duration to short-duration events or b) context to agent.

Sequential Assumption: the sequential order of change is unrelated to the nature of change itself.

Homogeneity Assumption: all like-patterned cases result from an identical set of causal circumstances.

The phenomena we term reality happens in action sequences located within constraining or enabling structures. It is always a matter of particular actors, in particular places at particular times (Abbott 1992, Sayer 2000). Marx understood the importance of process and wrote narrative explanations about social reality. For example, he follows his opening statement of how facts and personages always appear twice with (1937:4):

Men make their own history, but they do not make it as they please; they do not make it under self-selected circumstances, but under circumstances existing already, given and transmitted from the past. The tradition of

all dead generations weighs like an Alp on the brains of the living. And just as they seem to be occupied with revolutionizing themselves and things, creating something that did not exist before, precisely in such epochs of revolutionary crisis they anxiously conjure up the spirits of the past to their service, borrowing from them names, battle slogans, and costumes in order to present this new scene in world history in time-honored disguise and borrowed language.

Process is a fundamental building block of explanation, but logical positivists in the first half of the 20<sup>th</sup> century succeeded in substituting causality for process. Causality is a predicate of statements in an axiomatic structure with correspondence rules about the syntactic manipulation of variables that are mere stand-ins for reality rather than reality itself (Abbott 1992, Lloyd 1994, Sayer 2000). It is the difference between syntactic and semantic scientific explanations, and how balancing specificity and context gave way to explanatory reliance on causal forces acting with no reference to the agents of change themselves (Kolchin 2003, Lloyd 1994, Pera 1994). For example, "voltage" is partially defined by reference to readings on a calibrated meter such as a galvanometer even while the true number of observational situations and procedures suitable for defining voltage is open-ended.

It is entirely possible to formulate a theory that has no empirical application, even while being empirically meaningful because most things that could happen don't happen. A theory is a semantic (meaningful) structure that serves to anticipate the structure and behavior that a given phenomenon would have if it were isomorphic to the theory (Lloyd 1994, Pera 1994). However, the empirical meaning of a theory is separate from the empirical application of it. This is important (although irrelevant in syntactic explanations) because ecology is more than complicated physics and chemistry, just as society is more complicated than the theory of *Homo economicus* implies. The semantically interesting question is what could happen given physical and/or economic possibilities, but does not occur for ecological and/or social reasons?

Process is important to answering such a question because events occur in interlocked and

interdependent sequences forming a trajectory or regime (Abbott 1997, Russell 1997). Trajectories are characterized by their onset and duration as well as their inertial properties that resist change. They are widely recognized, although often vaguely defined, by both social and natural scientists (e.g., Agee 1993, Blench 1957, Foster, Knight, and Franklin 1998, Kitschelt 1992, Young 1982). Abbott (1997) calls trajectories the “master narratives” that coerce processes within them and prevent the subsidiary processes from disrupting the regime.

However, trajectories are periodically subject to radical shifts or turning points that redirect the master narrative. A turning point or disturbance is a short, consequential shift in a process that necessarily refers to two points in time, not just one (Abbott 1997, Pickett and White 1985). It is only by a sudden change succeeded by a period of relative stability that a turning point can be recognized. The potential and actual consequences of a turning point are at least partially accounted for by its frequency and severity. For example, McLachlan et al. (2000) show that what appear as stable, old growth hemlock stands in New England were previously hardwood stands converted by agricultural forest clearance (i.e., the turning point or disturbance) that caused a shift in the trajectory of succession. The contemporary hemlock stands neither resemble pre-settlement forests nor show signs of returning to pre-settlement conditions.

The coercive direction of a trajectory and the consequential effect of turning points on its stability lead to the final property of time critical to historical ecology: legacy. A legacy is what endures from the past once change has occurred (Foster, Knight, and Franklin 1998). In the study of place, legacies can refer to physical structures (i.e., sediment layers), biotic remnants (i.e., seeds) as well as cultural traditions (i.e., burning) that persist despite the redefined trajectory of a process resulting from a turning point. A long-term pattern of large, infrequent disturbance events constituting a “disturbance regime” exert an enduring influence on the landscape-level arrangement of vegetation and ecosystem process and this pattern influences the rate and pattern of energy flow, nutrient cycling as well as human and wildlife responses. Understanding how much of the past is in the present is fundamental to the

interpretation and management of ecosystems into the future (Peterken 1996).

## CONCLUSION

Members of varied disciplines increasingly recognize that few spots on earth have escaped the imprint of humans and that many of the elements we prize in nature are in fact the products of past cultural activity (Denevan 1992, German 2003, Simpson et al. 2001). How we interpret the past as producing the present and leading to the future is the real challenge. A critical purpose served by historical ecology is that of a window on systems with sufficient temporal breadth to make it possible to a) determine the coercive nature of a given process, b) the points of transition in this process, and c) the legacies of the past that endure in the new trajectory. By putting these three essential properties of time in service to historical ecology, anthropology is better positioned to understand what it means to be human. This in turn will further the discipline’s contribution to managing Earth.

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