Challenges and Opportunities for the Application of Historical Studies to Conservation

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Abstract

Studies from disparate ecosystems and many different landscapes worldwide demonstrate that historical research often provides important insights to ecological interpretations and critical guidance to conservation management including habitat restoration and the maintenance of biodiversity. Nonetheless, historical perspectives and environmental history remain incompletely incorporated into mainstream ecological studies and conservation planning. This paper identifies and discussed numerous factors responsible for this situation, explores ways of enhancing the status and application of historical ecological studies, and identifies notable opportunities for increased incorporation of historical approaches in conservation. Despite an apparent movement in environmental history away from ecological studies towards more cultural analyses there is a critical need and demand for more collaboration with historians, archaeologists and social scientist in ecology and conservation management.

Introduction

For many contrasting habitats, ranging from lakes to wetlands and forests and wilderness areas to pastoral landscapes, research on ecosystem and landscape history has provided major insights to ecological studies and constructive guidance to management activities. In many ways ecology is inherently a historical science[1] and it clearly benefits greatly from any sources that expand its temporal window. As ecologists learn more of the historical patterns and processes of the landscapes that they study they can better explain present conditions and anticipate and manage for future conditions.[2] In particular historical studies yield important information regarding: *baseline conditions* (i.e., conditions prior to some specific date or event) of ecological structure and composition, including the status of individual species preceding major changes in abundance or distribution; *natural disturbance regimes* including the frequency, intensity, distribution and ecological impacts of processes like fire, hurricanes, or geologic processes; the *range of variability* of environmental factors, vegetation dynamics, and populations levels of individual species; the details and trajectory of *slow, lengthy and infrequent biological or physical processes*; the *vulnerability, resilience and resistance of ecosystems* to various disturbances, stresses, and environmental changes; and the nature and *consequences of major cultural shifts* – e.g., European arrival, catastrophic decline of civilizations – that may have triggered past ecological dynamics.

Historical Perspective

Recognition of the value of historical sources for interpreting natural patterns and ecological processes is certainly not new, nor is acknowledgement that those insights might lead to more successful management of natural resources and systems. The journal writings of Henry Thoreau are replete with examples in which historical clues allow him to explain natural history observations in his Concord, Massachusetts countryside.[3] Like any good historical ecologist Thoreau utilized a wide variety of clues, ranging from historical sources (e.g., deeds, census records, the writings of early explorers and settlers), to field and natural history evidence (tree rings, soil morphology, wetland stratigraphy), to European and Native artifacts. While these sources enabled him to appreciate (and lament) the magnitude of the transformations in the wildlife, forests, and aquatic ecosystems of New England since European arrival, they also led him to major ecological discoveries. These ecological revelations included a sound interpretation of old field succession, insights into the biotic and abiotic factors controlling seed dispersal in common tree species, and a basic interpretation of wetland development. In addition, Thoreau's historical perspective prompted him to propose numerous, quite practical improvements to forestry practices (which he termed "forest geometry") and to advocate an approach to land management that combined historical interpretation and field biology with keen observations. As he put it so aptly, "Our woodlots, of course have a history, and we may often recover it for a hundred years back, though we do not … yet if we attended more to the history of our lots we should manage them more wisely."[4]

In similar fashion the early American leaders in ecology and forestry applied a historical perspective to forest ecosystems as they sought to understand the factors controlling the abundance of commercially valuable tree species and to develop effective methods for regenerating them. Frederick Clements, though now often slighted for his theories on community ecology applied historical techniques in his insightful studies on of landscapes dominated by lodgepole pine. Clements identified the central role of fire in controlling the pattern and dynamics of these forests and he clearly saw the practical application for this information: "And it is by means of fire properly developed into a silvicultural method that the forester will be able to extend or restrict lodgepole pine reproduction and lodgepole pine forests at will."[5]

Gifford Pinchot pursued a parallel intellectual track in claiming that silviculturalists would either need to mimic the effects of fire through their harvesting practices or actually apply fire in a controlled fashion if they were going to maintain many important timber species into the future. "In a word, the distribution of red fir (Douglas Fir) in western Washington, where it is by all odds the most valuable commercial tree, is governed, first of all, so far as we know at present, by, fire. Had fires been kept out of these forests in the last thousand years the fir, which gives them their distinctive character, would not be in existence, but would be replaced in all probability by hemlock…I hasten to add that these facts do not imply any desirability in the fires which are now devastating the West."[6] Pinchot's statement is intriguing as he clearly recognizes the management insights and dilemmas that may emerge from historical information. While he acknowledges the essential role of fire in contributing to the dominance of Douglas Fir in the northwestern landscape, he is aware of the negative cultural attitudes and many practical problems associated with fire. The lessons from history often place managers in an awkward position.

Historical insights have increasingly been promoted as a guide to natural resource management. Modern approaches such as "natural dynamics silviculture", "new forestry", and "ecosystem and adaptive management" are connected to the ideas of Pinchot and Clements through mid twentieth century literature such as "Ecological Forestry in Central New England" a paper by Stephen Spurr and Albert Cline in the mainstream publication Journal of Forestry.[7] For these New England authors the most effective silvicultural approach was one that worked with and learned from historical pattern and process. Much of their emphasis was on natural (as opposed to planted) stands and processes for which they advocated the study of old growth and virgin forests that were least affected by human activity. On these sites they and their successors employed a wide range of historical and modern approaches.[9] However, they also recognized that many landscapes and commercially important forests were shaped by centuries of cultural practices and they therefore also focused on land-use history and episodes of forest establishment, development, death and regeneration (Spurr 1955b).[10]

In the development of new approaches to forest management studies on natural dynamics at the stand, landscape and regional scales have been influential especially in mid-western and western landscapes dominated by extensive public ownerships. Historical information has yielded important new perspectives, including "natural range

of variability" which provides broad guidelines for desirable and acceptable conditions as targets for management. Among the outcomes of planning using this new perspective are: retention of living and dead trees in harvested areas to promote natural habitat in regenerating stands; spatial arrangement of harvesting operations across complex topographies to better mimic natural patterns of disturbance; and the designation of extremely large reserve areas to offer adequate habitat for mature forest, old-growth forest, and interior forest species.[11]

History Guiding Restraint

In guiding management, historical insights have prompted restraint as well as action. This phenomenon is well demonstrated by changing attitudes and management responses to the effects of natural disturbances. A long-standing reaction to the damage resulting from fire, windthrow, ice damage and defoliation has been the salvage of the affected trees. This response has been variously prompted by an inclination to minimize financial losses, to reduce perceived fire hazards, or simply to clean up an area. Salvage efforts are frequently accompanied by the interpretation that the disturbed forests are "destroyed" or "lost" or that the ecosystem has been catastrophically altered and the remaining material is essentially worthless lying in place.[12] While a variety of ecological studies have helped to alter these views, some of the most compelling arguments for valuing and maintaining these damaged sites have come from historical studies that characterize the long-term, natural dynamics of forest ecosystems. In many different landscapes retrospective studies have yielded similar conclusions, namely that many disturbances are inherent natural processes that occur regularly over time, that they are followed by rapid ecosystem recovery, and that they are critical for the maintenance of ecological pattern, biodiversity, and ecosystem productivity.[13] Backed by such historical evidence scientists and conservationists have been able to promote policies and management approaches that treat disturbances are important processes and the resulting landscapes as valuable habitat. [12]

Contributions to the Conservation of Cultural Landscapes

Importantly, however, the benefits from historical approaches to scientific and conservation endeavors are not restricted to natural areas, wilderness, or systems in which the desire is to mimic natural process; they are equally great in cultural landscapes. In many regions worldwide highly attractive and appreciated landscapes and valuable habitats have arisen as a consequence of human land use. These cultural landscapes are diverse and variable, ranging, for example, from grazing lands to managed hunting reserves to forests under long-term natural resource production. In many cases the cultural activity responsible for generating the current landscape condition are no longer operative or may be changing rapidly.[14] In situations where these landscapes support unusual, important or diverse biota or there is a desire to maintain the appearance of these areas due to historical, cultural, economic (e.g., tourism) or other reasons, historical research can provide guidance on the range of activities responsible for maintaining these conditions. These perspectives have been especially important in European nature conservation, and are the source of intense new debates concerning the historic role and

conservation use of large herbivores in maintaining open forest conditions.[15] Recognition and concern for cultural landscapes is just emerging as important in many different settings in the U.S.

Finally, insights often forged through a coupling of historical, archaeological, and paleoecological studies are transforming our perspectives on previously viewed pristine areas such as the vast forests of the Amazon Basin. While these insights have undercut many people's view of the Wilderness Myth they also raise provocative questions concerning the origins and maintenance of biodiversity in some of the world's most diverse ecosystems. Oftentimes they suggest radically new approaches to the management of these areas.[16]

Regardless of whether the predominant processes are cultural or wild, historical studies often yield many benefits beyond simple guidance. Such research frequently provides a rich site and landscape narration of environmental change and condition that is extremely useful in conveying resulting management plans to important constituencies, whether these be an administration policy review board or the general public.

Problems Remain

Despite the lengthy history of development and success described above the marriage between history, ecology and conservation is incomplete or lacking altogether. Why is this, what are some of the downfalls of a historical conservation, what can be done to rectify the situation, and, what are some of the exciting the opportunities? A discussion of some of the reasons underlying this situation is the central theme of this paper. We begin with some of the practical reasons that historical perspectives are often not pursued and then proceed to examine reasons that it is ignored or not followed.

1. **Much conservation is basically reactive or programmatic land protection that is not driven by any research, scientific or historical.**

In reality, much local to regional conservation is solely attempting to stem the relentless march of commercial and residential development. This work is inherently defensive or opportunistic in nature and practice. In many situations the non-profit organizations or agencies involved work with limited or volunteer staff that have little time or expertise to evaluate natural history characteristics or historical dynamics. Many of these organizations center on specific geographical areas, land (or water) attributes or simple taxonomic and ecological characteristics that can be readily assessed. Oftentimes the key factors under evaluation are economic – either the value of the products produced (e.g., in the case of some agricultural and forestry conservation programs) or the land under consideration. On these front lines of conservation, some of which are occupied by highly successful organizations that process and protect many parcels and acres annually, staff budgets do not allow for research and management. Where such organizations do draw on scientific perspectives science these frequently come from outside partners such as The Nature Conservancy or existing regional (statewide) conservation maps and

priorities. History, beyond the narrative of the owner's personal story seldom emerges as an element in the conservation action.

2. **History and its relevance are seldom taught to scientists, managers, or policy makers**.

Despite the well-publicized relevance of ecological history to management concerns at a national scale (e.g., regarding fire policy or wildlife management at Yellowstone National Park or in the deliberations of the Clinton Task Force on management of National Forests in the Pacific Northwest) most scientists, natural resource managers, and policy makers are not introduced to historical aspects of environmental science or resource management in their educational programs. Reconstruction and historical approaches (e.g., from environmental history, dendrochronology, paleoecology, archaeology, etc.) are seldom part of ecological or management curricula, they are only sporadically emphasized in agency frameworks management plan development, and they are not highlighted in the professional literature that is read by management personnel or their supervisors. While this is true for many public agencies it is especially applicable to on-the-ground practitioners such as consulting foresters, agency supervisors, and local land managers. As a consequence one of the most critical questions in ecology and conservation is seldom posed: "What is its (the ecosystem, species, or landscape's) history?"

3. **History is often rejected as a valid basis for management.**

In some cases, where historical questions are raised or answers are obtained their relevance to the modern situation may be questioned. One major argument that has recently been used to reject the relevance of history as guidance for modern management is that new, largely anthropogenic forces have changed the environmental setting and scene at local to global scales. This perspective argues that the former rules concerning the dynamics and behavior of ecological pattern and process no longer pertain and have been superseded by a new set driven by the novel environmental setting of our day. In this new world in which novel organisms, stresses, disturbances and environments prevail, the argument goes that we need new approaches to interpretation and management. Expectations and management approaches based on prior conditions may no longer work. At a global scale this interpretation is one possible take home message from works such as Bill McKibben's *The End of Nature,* which argues that under a new global change scenario in which the climate is altered by greenhouse gases all environments are essential cultural and novel.[17] Under this scenario rules from the past are of limited utility. At a local scale some forest managers have argued that the introductions of non-native pests, pathogens and plants and pollution impacts such as ozone, nitrogen deposition and acid rain will lead to previously unknown ecosystem structure, composition and responses, which require new approaches to management.

4. **Historical studies yield undesirable answers**.

One of the characteristics of historical studies is that they often provide surprising results, including answers that run counter to general wisdom or long-held conviction. While such results are scientifically exciting they may lead to interpretations and management recommendations that undermine the established approaches of the supervising individuals or management organizations. One example that has arisen frequently in North American landscapes and is arising increasingly in tropical landscapes is the studies that show that many landscapes previously interpreted as natural are actually shaped by ancient human activities. These results generally call for completely new ways of ecological thinking. They also often pose major problems to organizations that have based their conservation work on natural processes and interpretations and individuals whose well-reasoned ecological interpretations omit a human factors.

For managers the suggestion of a strong human role in the creation of modern conditions may provide a significant dilemma. If desirable species, assemblages, or habitats are in some way dependent on past cultural activity should we seek to maintain or promote them? If yes, do we proceed by mimicking or reproducing this human activity? American conservation and much conservation work in tropical regions have been strongly associated with the protection and perpetuation of wilderness, primary forests, and natural areas these questions are particularly difficult to confront. In many ways they force groups that have held a clear distinction between the restoration of nature and cultural sites to confront the ambiguity that often exists in reality.

A classic example of history yielding unexpected and disconcerting results is presented by attempts to conserve and restore upland grasslands, heath land, and shrublands in the coastal northeastern U.S. These habitats are a focus of intense conservation activity because they support unusual and uncommon assemblages of plants and animals in a region dominated by forests and they are threatened by the encroachment and growth of trees and large woody plants.[18] As woody growth expands there is a marked degradation of habitat quality for many important species and a gradual decline in number of sites supporting species such as grassland birds and butterflies. Consequently, although the first priority of conservation organizations was to purchase and protect these areas from development, the emerging priority has become managing these areas to maintain them. Given this situation the critical research question is: What processes have created and maintained these treeless habitats in the past and might these be employed to restore and improve the areas in the future? Due to their native flora, apparent lengthy persistence, and relative stability on a decadal time frame these attractive landscapes have been frequently interpreted as arising from a combination of natural environmental factors (e.g., droughty conditions on sandy soils; exposure to coastal winds and salt) and Native American burning and horticulture. Based on this interpretation and the belief that these habitats have existed for millennia the preferred management treatment for these habitats has become prescribed fire. To this end many conservation organizations and state and federal agencies have developed significant capabilities for using prescribed fires as a conservation management approach on these haititats.[19]

However, a range of historical analyses across a broad array of sites and landscapes confirms that the broad-scale abundance of these landscapes and their constituent species is predominantly a consequence of the widespread deforestation, grazing, plowing and other agriculture activities that have occurred since European settlement. Although there is certainly evidence for Native American burning and horticulture the scope of this activity was limited and the nature of the resulting habitats is completely unknown. All of these sites, plus vast expanses of the forested landscape were completely deforested and modified intensively by Colonial farmers and their millions of grazing animals. Consequently, the mid 19th C the New England landscape was covered with a vast array of open habitats that supported diverse assemblages of openland species that had been uncommon in the pre-European landscape. With regional agricultural decline and reforestation these habitats decreased in number and extent. Remaining open areas occupy sites that are more recently abandoned, were more intensively disturbed or are more environmentally stressful. Importantly, the current structure, composition and distribution of these important habitats that add significantly to regional biodiversity, is overwhelmingly driven by European cultural activities rather than Native American or natural disturbance processes.[20]

This interpretation generates numerous complications and problems. On the one hand, the relatively recent origins of these habitats and their clear association with deforestation and agricultural activities are troubling to individuals who have interpreted them as longstanding and "natural" parts of the New England landscape. The cultural origins of these habitats raise the fundamental question for many individuals and organizations as to whether they should be protected at all. The obvious management treatment: cutting, grazing and mowing is distasteful to many groups grounded in relying on natural processes or the management of a semi-natural process, fire. This is especially true as the desired end conditions are best achieved by management activities that can easily be characterized as environmentally degrading—such as overgrazing and soil scarification. This is true because one key factor leading to the quasi-stability of open habitats such as heathlands and some grasslands is the nutrient poor status of soils; this condition can be maintained or accentuated by intensive land-use activities that enhance nutrient leaching, volatilization and other processes.[21] Finally, the large effort, expense, and public relations outreach that many organizations and agencies have invested in developing prescribed burning programs makes it difficult to accept the fact that fire is almost always a process of secondary importance in creating and maintaining these landscapes. When historical studies yield such surprising and uncomfortable management recommendations they can lead to rejection of the research, the recommendations, or the approach. In the case of coastal openland habitats all three responses have occurred, although some conservation organizations have certainly begun to experiment with the application of grazing animals and mowing regimes.

5. **An inability to adopt the recommendations.**

In perhaps many situations the results of historical ecological studies yield conclusions that are simply impossible to implement in an effective management regime. This outcome may be reached for a variety of practical reasons. In fire-prone landscapes

the obvious need to manage with fire (either by prescribing fires or by allowing natural fires to burn) is often precluded by safety concerns. Another common problem confronting controlled fire is that existing environmental regulations constrain burning to conditions or applications that produce very different fire behavior and effects than the extreme fire conditions that would have supported the historically intense wildfires. For many organizations and agencies economics prohibits effective or historically accurate treatment. In the case of the openland conservation in New England, the reintroduction of grazing animals, mowing, or the application of controlled burning is often so expensive that only small areas can be treated effectively.

Historical inquiries may also lead to other types of intractable management situations, especially when natural disturbance processes are involved. In a detailed study using a variety of paleoecological, historical and modeling approaches Jim Clark was able to reconstruct the fire regime, climate history and vegetation dynamics of pine dominated landscape in northern Minnesota yielding the conclusion that the disturbance and landscape were non-stationary, i.e. continually changing.[22] Due to ongoing and continual climate change the landscape conditions at any given time are actually determined by a historic disturbance regime under climatic conditions that no longer prevail. Given that the natural fire regime is continually changing, which fire regime does a manager prescribe to the modern landscape? This question might be addressed using models of fire behavior, climate and vegetation and informed by historical evidence, but historical insights provide few direct guidance.

In many other situations the ecosystem may have changed to such an extent that it is no longer possible to restore it using historical processes.[23] In this case, although the historical insights have yielded interesting information they may also suggest that there is little ability to recover these former conditions. This is frequently encountered in landscapes in which processes such as fire have been removed by human intervention for lengthy periods of time. In landscapes ranging from sub-boreal landscapes like the Boundary Waters Counoe Area Wilderness, Sequoia forests, and ponderosa pine forests the vegetation has changed so much from historically conditions that if fire were reintroduced it would behave in novel ways, resulting in novel vegetation dynamics.

6**. Historical interpretation is disputed/rejected.**

Not surprisingly, even when historical studies are undertaken they frequently lead to contentious debate, either because there are fundamental disagreements concerning the historical conditions and processes or because different groups focus on different periods of time. There are countless examples of this situation ranging from the interpretation of the natural abundance of wildlife (e.g., elk, bison, deer, and wolves) in our national parks to the frequency and intensity of fire in many western landscapes.

A good example of this situation, and one in which the decisions have involved extraordinary levels of funding, is the attempt to restore the Atlantic Salmon in southern New England. Over the past few decades federal and state governments and the electrical generation industry have spent more than $100 million dollars addressing

environmental conditions, developing fish ladders and elevators, and supporting a large hatchery and restocking program in an effort to establish a salmon run in the Connecticut River.[24] This effort is based on a widely and passionately held belief that salmon were abundant before Euroepean arrival and into the 19th C but declined subsequently with dam construction and increased pollution. To-date, although these efforts have achieved remarkable improvements in water quality and allowed other anadromous fish, including shad to develop large annual runs, the effort has been a complete failure in restoring salmon. Despite more than thirty years of intense stocking of Atlantic Salmon (approximately 10 million fish are currently released annually) less than 50 fish have returned annually over the past five years. A review of the federal record and documents pertaining to the development of the federal program and legislation indicate that the project was undertaken without any background historical or archaeological study. Remarkably, the interpretation of large historic and prehistoric runs of Atlantic Salmon are largely based on anecdotal and second-hand historical accounts. These include statements such as:

> "[Atlantic salmon], which were sometimes so thick in the rivers that they overturned small boats, were probably as vital to the aborigines as the wild turkey…To an extraordinary extent salmon served the Indians as the staple in their diet" Netboy 1971.

> "Connecticut River, undoubtedly one of the best salmon streams in America." Dunfield 1985

> "[Atlantic salmon was] at least as plentiful as Pacific salmon". Rostlund 1952 (in Carlson 1992).

> "The Atlantic salmon rivaled the cod as an important and reliable source of protein to the early New England colonists" Kimball and Stolte 1978.

> "Although precise figures are not known, popular accounts of the day indicate that Atlantic salmon were quite abundant in New England during Colonial times. It is estimated, for example, that the Connecticut River population at that time was as high as 140,000 salmon. According to one account, the fish was so common that indentured servants who worked in lumbering camps of the day had written into their contracts a limitation on the number of times per week they would be served salmon. Reports of fishermen landing hundreds of fish with one throw of the nets were not uncommon" Connecticut River Atlantic Salmon Compact Act. House of Representatives Report No. 98-392.

> "Fish were so abundant along the [Connecticut] river shores that apprentices, in signing up for study and keep, would stipulate that salmon would be served no more than twice a week. (In those days, shad was considered as fit for only the very poor or for use as a fertilizer.) Edmund Delaney 1983 . [25]

A rigorous historical investigation initiated independently in the 1980s by Cathy Carlson an archaeology doctoral student at the University of Massachusetts yielded quite a different and more sobering interpretation.[26] Her comprehensive assessment of all known archaeological sites and fossil materials, coupled with focused digs in likely areas yielded no evidence of prehistoric use of salmon by Native Americans in New England. In fat, a total of five bones were uncovered from all sites; these were concentrated in northern Maine. Historical documents were shown to be exaggerations, mis-identifications or issues of nomenclature in which terms like "white salmon" actually referred to shad. While there is historical evidence of salmon runs in the 18th C, during

the Little Ice Age, the coldest period in the last five millennia. Consequently, the conclusion reached by Carlson and supported by her advisor Dina Dincauze was that the Connecticut River is climatically outside (south of) the native boreal and sub-arctic range of salmon; only under extreme cold conditions such as the Little Ice Age was its range extended into that watershed. The disappearance of the fish from the river resulted from climate warming and only coincidentally with the 19th C deterioration in environmental conditions and dam construction. Given the significant warming through the 20th C and the projections for even greater warming in the near future the ongoing restoration project appears to have little potential to succeed. However, a relevant anecdote is that the archaeological and historical information presented by Carlson has had no apparent effect on the ongoing restoration program.

Opportunities and Challenges - Where Do We Go from Here?

The collaboration between historical disciplines, ecology and conservation has reached an uneasy point in its history. On the one hand there is a long-standing recognition that the temporal perspective offered by history and other disciplines provide retrospective information that is critical to many ecological inquiries and management activities. Use of this perspective has provided for important scientific advances and has proven instrumental in defining new management policies and approaches. On the other, many groups of scientists and organizations remain ignorant of the benefits of historical insights. Recent analyses of the state of environmental history by some of its leading voices suggest that this historical discipline is actually moving from its close association with ecology and environmental studies to favor increasing emphasis on social and cultural analyses (William Cronon and Donald Worster, at the ASEH Meeting in Providence, RI).[27] Given this situation how might we enhance the use of history in ecology and conservation? I believe that there are many opportunities to promote these efforts and that there is exciting potential for novel insights and approaches to emerge from further collaborative work. Some of these opportunities are explored below.

Broaden the Exposure of Successful Collaborations

Many of the most exciting examples of history informing environmental science, ecology and conservation are hidden away in technical and scientific publications that reach small and narrow audiences. There is need and opportunity to broaden his exposure in order to reach the practitioners (i.e., the foresters, landscape architects, conservation and restoration biologists), the administrators and the policy makers. What is needed are case studies and overviews laying out success stories of history informing interpretation and management. In venues ranging from the Journal of Forestry to Restoration Biology the take home message of these stories can be that historical perspectives enable work to be accomplished more efficiently and effectively and ultimately with more guarantee of success.

Extend the Collaborations Themselves

It is ironic that at a time when ecologists and their major funding agency, the National Science Foundation, have recognized the critical need to reach out to social scientists and environmental historians in their studies, that there is a feeling in environmental history circles that the discipline is moving in the opposite direction. This is especially troubling given the great success of many early, as well as recent works in environmental history (e.g., *Changes in the Land, Forest Dreams, Forest Nightmares, Nature's Economy, Reclaiming the Commons*)[28,] , which have successfully encouraged the ecologists and conservation biologists to seek out collaboration. Clearly there is a need to reverse this trend, perhaps with the scientists and conservationists providing the impetus this time around. With the movement of major research initiatives such as the Long Term Ecological Research program, supported by NSF, to broaden their disciplinary base and the focus of emerging national efforts such as the National Ecological Observation Network on cultural and temporal as well as environmental and ecological processes, there should be a strong emerging base for collaborations among historians and ecologists.[29]

Expose the Value of the Remarkable Array of Untapped Resources

One misconception that many ecologists bring to their studies is that most of the good historical sources have been explored and much of the history of a region and site under investigation is already well known. This is especially true in regions like New England where the extent of historical scholarship in history, ecology, and environmental sciences is extensive. However, it turns out that even in apparently well-researched landscapes that there are surprising numbers of untapped resources that yield remarkable new perspectives on landscape, ecosystems and species histories. Identifying these opportunities and working with new materials and approaches raises the this potential for completely new perspectives in ecological studies. Success in such efforts will be an essential step in drawing new people and energy to these endeavors. A couple of examples from recent studies in New England illustrate this point.

For decades ecologists in the mid-west and west have been exploiting the General Land Office Surveys to develop excellent spatial databases on the vegetation and disturbance processes at the time of European settlement. Corresponding surveys from other regions have been used effectively as well, as indicated by the early studies by Tom Siccama in northern Vermont and the scholarly book by Gordon Whitney on the forest history of the Eastern U.S.[30] Gordon illustrated the potential for using many different types of surveys and he drew attention to the wide range of source materials in New England, such as proprietors' records and surveys. Nonetheless it was only in the last decade that a group from the Harvard Forest joined with Charlie Cogbill from the Hubbard Brook LTER site to systematically exploit these records comprehensively. Using a combination of proprietors records and road surveys obtained by visiting town halls and county courthouses in essentially every New England town, this group pieced together the first map of early New England forest vegetation based on real data.[31] These sources data back to 1655, but have been lying unused by ecologists or historians. However, the resulting map has been of immediate use for a range of ecological and applied studies.

In similar fashion, historians and ecologists have long known of the existence of township maps developed under legislative directive in 1830 that show the distribution of forests, wetlands, major industries, roads, and cultural features. Because 1830 lies close to the height of deforestation and agricultural development in the region, these maps offer a glimpse into the highly fragmented condition of the Colonial landscape. For ecologists and conservationists this represents a critical tool: a map of the least disturbed parts of the landscape and the continually forested tracts of land through time. Since the mid-19th C most of the open land has reforested and so the current woodlands are comprised of both secondary forests on old-agricultural land and primary forests that have never been cut.[32] The 1830 maps allow ecologists and conservations to locate these areas of primary forest efficiently. Nonetheless, until we proceeded to secure and digitize the maps available for 250 of the state's 305 towns there had never been an attempt to develop a comprehensive view of this historical landscape. The resulting map has been the single most requested database produced at the Harvard Forest. It is widely used at a township level by land planners and land trusts and at a state level by conservation organizations and state agencies in prioritizing forest lands for protection. For ecologists and conservation biologists the maps have guided studies studies ranging from comparisons of floras on secondary and primary forests and the importance of land-use history in the distribution of exotic invasive species, to investigations of amphibian distribution relative to historical forest fragmentation and the modeling of long-term carbon and hydrological dynamics.

Finally, there are critical historical data emerging regularly that remain ignored by ecologists. Other than conversion to commercial and residential uses, the single greatest impact on forests in the eastern U.S. is forest harvesting. Although the bulk of U.S. timber resources are imported or produced in the western, Midwestern and southeastern U.S. the northeastern forests are harvested at a surprisingly high rate. This activity has important ramifications for forest composition, carbon dynamics, and habitat quality among other things. Since private individuals own as much as 80% of the forestland in relatively small parcels there is generally little information available on this activity. Remote sensing, which is useful for conducting broad-scale assessments of harvesting activity in landscapes where clear-cutting is prevalent is generally of little use in the eastern landscape where much of the harvesting involves selective removal of individual and groups of trees, oftentimes comprising 25 to 75 percent of the forest volume. However, in Massachusetts a regulatory statute established in 1985 that requires each landowner, from private individuals and organizations to municipalities, industry and public agencies, to produce comprehensive plans and maps for each commercial harvest.[33] Consequently, a treasure trove of data on a critical ecological process lies filed away in countless agency cabinets. Beginning in 1990 we commenced to secure all 15,000 of the plans for the last 20 years and to enter and digitize the data. The result is a statewide map depicting the pattern, date, intensity and size of every cutting activity, accompanied by a database containing landowner, quantitative, and other ecological information. This database has immediate application to conservation. It allows the calculation and identification of uncut and cut blocks of land; it provides a ready source of information for future land management discussions, and it conveys to organizations and policy makers the extent of current forest disturbance. For scientists the data are equally valuable as they enable new calculations of carbon dynamics and broad-scale

disturbance patterns; they allow for efficient selection of study sites for any research focused on harvesting and human land use; and they provide a focus for studies directed towards the dynamics of wildlife and invasive species. Together with the 1830 maps these data are the present focus of more than a dozen research projects.

Conclusion

While it is certainly true that bringing other disciplines and perspectives into the pursuits of ecologists and conservation biologists has added complexity and challenge to interpretations and the development of useful policies, it has brought immeasurable benefits. The fact that many scientists and managers continue to lack the back ground or desire to pursue such collaborations results in many mistakes and the development of misguided management approaches. Ecology, at least is actively seeking to expand its interdisciplinary activities to, among other things, employ a broad range of historical approaches that add temporal and cultural breadth to research and application. One hopes that social scientists and environmental historians find such collaborations to be engaging and fruitful.

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[4]Henry D. Thoreau Journal. October 16, 1860.

[5]Frederic Clements

[6]Gifford Pichot

[7]Spurr and Cline

[8]Cline and Spurr 1941

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