Historical Ecology in Disciplinary Contexts

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Among several methodological and theoretical approaches that detail and track key elements of the human–environmental nexus and the linkages of biotic and abiotic agents and their behaviors through time (e.g., resilience, ecosystem dynamics, environmental history, and landscape biography models), the framework of historical ecology offers a comprehensive and integrated reach across knowledge sectors and clear strategies for social justice, collaboration, and application.

There is no particular need to identify one's work as historical ecology, as several other approaches employ similar principles. However, the term is widely familiar, teasing ecology to embrace the historical sciences and history to learn ecology. Historical ecology is an umbrella term describing multi-faceted research programs that assure researchers and stakeholders the advantages of diverse perspectives, the means to evaluate and share information, and a community of practice. Historical ecology unites a group of core disciplines—archaeology, anthropology, ecology, geography, and history—and draws on parallel developments in these fields.

Keywords: historical ecology ; regions ; archaeology

1. Finding Tools to Meet the Future

Multiple crises, which menace not just humanity but all life on Earth, are unfolding. With its link to global warming, heedless management is accelerating the collapse of ecosystems everywhere; this means that all practitioners, whether they are scholars or anchored in a landscape, must collaborate to meet this unprecedented challenge.

How can the disintegration of ecosystems, the foundation of life on Earth, be halted and these critical systems be rehabilitated? For scholars, the action list is long: increase the pool of expertise by engaging all relevant knowledge communities, collect rapidly disappearing data, analyze with both familiar and new methods, and apply the results of actionable science to policy and practice [1][2]. This enormously complex and urgent activity requires an integrated research framework with the flexibility to accommodate the global diversity of places, peoples, and processes and to examine future options.

Based on evidence of environmental change and human activity, the framework termed historical ecology assembles tools to construct an evidence-validated, open-ended narrative of the evolution and transformation of specific ecosystems and landscapes. The term historical ecology includes humans as a component of ecosystems' evolution and defines history in a way that goes beyond the written record to encompass both the history of the Earth system and the social and physical past of humans and other species. The core idea of historical ecology is that all sources of knowledge are combined to understand perspectives on the past in a specific place, so that its future can be more wisely managed [3][4][5].

2. Climate Change Remodels Landscapes

The availability of water will be an increasingly constraining variable in finding regions suitable for growing food as well as fibre, fuel, and fodder [6]. An ancient example comes from North and West Africa, which—due to monsoon rains in the late Pleistocene—was a region of springs and permanent lakes; the population subsisted on abundant resources that supported hunting, fishing, and gathering. With settlements anchored near water and easy access to diverse biomes and ecotones, they voyaged like ancient mariners across arid and desertic areas to find a large selection of food in water bodies, woodlands, savannahs, and oases [7]. Drawings in rock shelters and caves depict their dead as swimmers in the sand, between the islands of life and the afterlife [8]. After ca. 6000–5000 BP, the region became steadily drier; the population began to practice pastoralism and moved to the more reliable water source of the Nile River, bringing their religion with them, and founding one of the great civilizations of the world [9].

3. Landscapes: Building Frameworks and Standardizing Practice

Persistent landscape types (forests, arable land, wetlands) and functions (community-managed land, sacred places) are of particular interest because considerable evidence can deepen the baselines for key resources and activities. The research designs of landscape ecologists and archaeologists can easily accommodate other fields of study (e.g., heritage and regional planning; climate change; sustainable management).

Early work in historical ecology focused primarily on landscape types. Many established research groups study a particular mountain, forest, or grassland landscape: an early example of historical ecology as policy is the U.S. Geological Survey's work in the southwestern Rockies [10]. An early national approach is the Swiss Federal Institute for Forest, Snow and Landscape Research [11], founded in 1885 and using historical ecology since the 1990s; researcher-driven transdisciplinary work focused on the Pyrenees began about the same time [12].

While scaling, politics, and other issues impede more recent global-scale management, mountains, uplands, and forests are often studied at regional and trans-border scales [13][14][15][16][17][18][19][20]. Landscapes that were once managed as commons have been brought back into view, using a historical ecology approach termed 'environing' [21]. Scholars and practitioners under the aegis of the International Association for the Study of the Commons has planned a forest commons conference [22].

The traditional and sustainable management practices of LID communities have been explained and promoted in several contexts; good examples are several decades of regional and cross-boundary work to explain Saami practices to Scandinavian governments [23] and to rehabilitate traditional solutions [24][25]. Connections between the ongoing disappearance of African wetlands and the expansion of agriculture offer another example of how the regional study of shifting relations among landscape elements can signal major issues such as the decline of biodiversity or looming water shortages [26][27][28]. Funded by the European Research Council [29], the MEMOLA project studied four mountainous European landscapes (in Spain, Albania, and Italy) to analyze agroecosystems that both maintain tradition and ensure the livelihood of rural communities over time.

These place- and region-based landscape projects serve the historical record, guide current decisions, and strengthen future management. Publishing outlets for local and regional work are expanding, notably the interdisciplinary journal Regional Environmental Change [30], the goal of which is to understand change, causation, and impacts at all territorial scales between the local and the global, whether they are defined by natural criteria (e.g., watersheds, ecosystems) or by human activities (urban areas/hinterlands).

Among the newest of international programs in this arena is the UNESCO BRIDGES global research coalition. BRIDGES [31] aims to integrate with UNESCO's Management of Social Transformations [32] intergovernmental science program. The aim of the coalition is to better integrate humanities, social science, and local and traditional knowledge perspectives into research, education, and action for global sustainability at local and territorial scales.

The European Research Council has funded additional future-oriented landscape projects. HERCULES [33] has a focus on the empowerment of public and private actors to protect, manage, and plan for sustainable landscapes of significant cultural, historical, and archaeological value at local, national, and pan-European scales. The European Commission has funded TERRANOVA [34], which trains next-generation researchers by charting shifting energy regimes as they have impacted land use strategies in Europe and demonstrates how landscape managers can draw on place-based solutions. The Commission also funds HERILAND [35], which addresses heritage management by exploring new ideas, tools, and training to ensure that interdisciplinary, research-based heritage, landscape management, and spatial planning are positively integrated with business activity, development, and democratic decision making.

At the national level, the U.S. National Park Service [36] published their strategy to manage cultural resources and climate change [37]. This inspired a group of researchers to form Climate Change Strategies and Archaeological Resources [38]. The group wishes to enhance archaeology's effectiveness with policy makers to increase knowledge about the multiple challenges that climate change has posed to the valuable and irreplaceable historical record.

Researcher-led coalitions have established the Historical Landscape Ecology Working Group [39], where members of the International Association for Landscape Ecology [40] and the International Association of Landscape Archaeology [41] share research and perspectives [42][43]. A group of researchers from many disciplines formed the project Integrated History and Future of People on Earth [44] in 2004. Founded on the principles of historical ecology, this global network has projects that feature collaboration with LID communities.

Global warming has already begun to transform familiar landscapes in ways that are difficult to predict in detail. French growers have begun to prepare for the future of their storied wines by working closely with climatologists, biologists, economists, sociologists, geographers, and geneticists to begin the process of adapting to anticipated climate change [45][46]. In Sicily, olive growers have embraced historical ecology to prepare for changing conditions [47]. A geological and archaeobotanical approach to land-use change is used to identify and protect High Nature Value (HNV) Sicilian farmlands for the future [48][49].

4. The Land-Water Ecotone: Policy-Oriented Research Design

Seventy-one percent of the Earth's surface is water. Oceans and brackish water comprise about 97% of that quantity and play an important role in feeding the world's population. Fresh water—from rivers, springs, streams, lakes, and ponds—while accounting for only 2.5% of the planet's water, is vitally important for human consumption and for agriculture [6][50][51]. Throughout human history and just like the early Egyptians, people have chosen to live at ecotones, where several ecosystems converge and the biotic diversity is greatest. Lacustrine and riverine environments nourished our species; especially favored were places where a short distance separates fresh and saltwater, where rivers meet the sea.

Archaeologists can read past and present landscapes that allow them to find these places, even as shorelines and the courses of rivers have remodeled the landscape. There, they excavate the debris from long-ago expeditions to locate food, entwining human activity with the health and behavior of many species. Thus, sites containing the remains of kills and catches enter the archaeological record and allow deep knowledge of both prey and their environments. Particularly important in wildlife introductions and species history, genetic analysis can be undertaken with material from archaeological sites and collections [52]. These sites are time capsules for land and water species' histories, ecosystems, water quality, and the resource management and culinary practices of the searchers. As millennia-deep ice sheets melt, rising sea and lake levels and floods threaten these shoreline archives [53][54].

An important advantage of collaboration among archaeologists, zooarchaeologists, and paleoecologists is that baselines—a guideline or beginning point of reference—chart the history of entities (such as species) or phenomena (such as salinity) over time [55][56][57]. Thanks to a variety of techniques, it is now possible to trace species and ecosystems over centuries and millennia, enabling the assessment of shifts in climate, ecosystems, and species' abundance and health; these tools are especially useful in conservation [58][59][60].

Marine historical ecology (MHE) offers fruitful applications of historical ecology and environmental history to marine ecosystems [61], shorelines [62][63][64][65], and island ecosystems [66][67][68]. The continuing importance of coastal wetlands is underscored in the long-term analysis of their storm protection [69]. Much of this work has been accomplished by collaborating regional groups. The vibrant alliance of scholars with indigenous groups along the North Pacific façade has re-invigorated ancient practices to ensure the health of coastal resources such as herring and clams [70][71]. In south Florida, a deep-time study of marine resources in the Gulf of Mexico traces more than a thousand years of fishing and collecting [72]. The Distributed Long-term Observing Networks of the Past [53] assess human behavior and environmental change in the Arctic and subarctic regions over space and time. All these collaborations engage multiple knowledge communities, both of heritage and of practice, while addressing climate change [73][74][75][76][77].

A seminal article [78] outlines how MHE researchers have taken the integrated methods of historical ecology directly to policy makers, and then followed up by analyzing whether the desired effects are reached and maintained. This muscular approach is a blueprint for action, precisely what is needed to ensure that historical ecology changes the thinking of policy makers and is thereby standardized.

The article identifies six policy themes: climate change, biodiversity conservation, ecosystem structure and function, habitat and seabed integrity, food security, and the importance of including social and economic considerations and facilitating 'bottom-up' governance to balance 'top-down' policies. It would not be too difficult to craft similar items for landscapes, thus clarifying collective goals while placing emphasis on policy.

MHE research reflects and explores these principles [79][80].

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