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Historical ecology: past, present and future

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Abstract

The term ‘historical ecology’ has been used with various meanings since the first half of the 20th century. Studies labelled as historical ecology have been produced in at least four academic disciplines: history, ecology, geography and anthropology. Although all those involved seem to agree that historical ecology concerns the historical interconnectedness of nature and human culture, this field of study has no unified methodology, specialized institutional background and common publication forums. Knowledge of the development of historical ecology is also limited. As a result, the current multitude of definitions of historical ecology is accompanied by divergent opinions as to where the origins of the field are to be sought. In this review, I follow the development of historical ecology from the 18th century to the present. In the first part, I briefly describe some early examples of historical ecological investigations, followed by a description of the various scientific strands in the 20th century that contributed to the formation of historical ecology. In the second part, I discuss the past five decades of historical ecological investigations in more detail, focusing mostly (but not exclusively) on works that their respective authors identified as historical ecology. I also examine the appearance and interconnectedness of the two main trends (ecological and anthropological) in historical ecological research. In the last part, I attempt to outline the future of historical ecology based on common features in existing research. It appears that at present historical ecology is at the crossroads. With rapidly growing interest in historical ecological research, it may move towards institutionalization or remain an umbrella term.

Keywords

historical ecology; interdisciplinarity; anthropology; human–nature interactions; environmental history

I Introduction

Learned people developed an interest in the relationship between humans and the rest of nature already in Antiquity (Glacken, 1967). Since modern science began to take shape in the 18th and 19th centuries, this interest has become part of several established academic disciplines. Some of these disciplines had a diachronic focus and consequently studied human–nature interactions in the past as well as in the present. While the subject matter of such investigations did not necessarily differ much, they were termed, among others,

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landscape history, environmental history, historical geography, environmental archaeology, forest history or historical ecology. Irrespective of whether one focuses on methodology or basic research areas, the borders among these (sub)disciplines remain fuzzy (Williams, 1994; Rackham, 2000; McNeill, 2003). Nonetheless, most (sub)disciplines mentioned above have gone through a development process that has positioned them as accepted parts of academia, as expressed by university departments, specialized journals, learned societies and regular conferences. A prominent exception is historical ecology.

The term ‘historical ecology’ has been used with various meanings since the first half of the 20th century. Studies labelled as historical ecology have been produced in at least four well-established academic disciplines – history, ecology (including palaeoecology, landscape ecology and conservation/restoration ecology), geography and anthropology. Researchers from differing disciplinary backgrounds described and defined historical ecology in different ways. Although all those involved seem to agree that historical ecology is concerned with the historical interconnectedness of nature and human culture, this field of study has no unified methodology, specialized institutional background and (with few exceptions) common publication forums. Recent studies (Girel, 2006; Bürgi & Gimmi, 2007; Szabó & Hédl, 2011) identified three main trends in historical ecological research: the anthropological, the ecological and the conservation/restoration ecological. It is, however, not implied that these trends are directed towards convergence.

Knowledge of the development of historical ecology is also limited. Studies that attempted to define historical ecology usually did not devote more than a paragraph to its historical development. As a result, the current multitude of definitions of historical ecology is accompanied by divergent opinions as to where the origins of the field are to be sought. This is not to say that there is a lack of historiographic studies on the development of research on human–nature interactions in the past. Quite the contrary, a number of publications paid detailed attention to the topic. However, such works were written from the perspective of environmental history (White, 1985; Worster, 1988; McNeill, 2003; Locher & Quenet, 2009), historical geography (Merrens, 1965; Williams, 1994), palaeoecology (Ferguson, 2000; Sarjeant, 2002) or landscape archaeology (Darvill, 2008). Historical ecology has common roots with all of these disciplines, therefore many of the pioneering works on past human–nature interactions could also be considered from the viewpoint of what later became known as historical ecology.

Given the above, there appear to be two possible approaches to study the development of historical ecology. The first is to follow as deeply as possible in the past the history of investigations that resemble the ideas and methods of current historical ecology. The second is to concentrate on self-conscious historical ecology, that is, to study the appearance and development of works that were explicitly identified by their authors as historical ecology. Within the latter approach, it is also possible to focus on the semantic development of the term ‘historical ecology’ itself. Both approaches have advantages and disadvantages. The first provides the necessary historical context to the development of historical ecology. It identifies the intellectual foundations and early attempts without which later developments would be impossible to interpret. However, it is necessarily subjective in assigning certain works to the historical ecological tradition while ignoring others. The second approach has a

more restricted focus. Because, as argued above, historical ecology lacks a generally accepted definition, this approach fosters a more structured and objective understanding of current trends. However, by the same token it falls short of acknowledging works which, although their subject matter and methods would allow for this, did not identify themselves as historical ecology.

The most desirable method is clearly a combination of the two approaches. However, a comprehensive review of both is undoubtedly beyond the scope of this paper. A full investigation of the intellectual and practical roots of historical ecology alone would require a book-length study [as Worster (1977) did in his work on the history of ecological ideas]. Even a thematically more restricted analysis focusing on self-conscious historical ecology cannot aspire to include all studies in every possible language. In this review, I set out to achieve more modest goals, which I hope will provide foundations for further studies. More specifically, in the first part of this review I will briefly describe some early examples of historical ecological investigations reaching back to the 18th century, followed by a description of the various scientific strands that contributed to the formation of historical ecology. This part will also include the early history of the term 'historical ecology'. In the second part, I will discuss the past five decades of historical ecological investigations in more detail. This part will mostly (but not exclusively) focus on works that their respective authors identified as historical ecology and will also include a list and analysis of all available descriptions and definitions of historical ecology. I will also examine the emergence of the main trends in historical ecology as well as their interconnectedness. In addition, I will provide an overview of where, according to the analysis of current trends, historical ecology might be heading in the future. I add that although explaining why historical information is relevant for the understanding and management of current ecosystems is a topic of paramount importance, it has been covered elsewhere (Szabó, 2010, with further literature) and does not form part of this review.

This paper is admittedly anglophone in its focus. To some extent this is justifiable because of the pioneering role of British researchers in historical ecology, which was often acknowledged in papers written in other languages as well (e.g. Girel, 2006; Moreno & Montanari, 2008; Cevasco & Tigrino, 2008). In addition, since around the year 2000 international research (especially in ecology) has been increasingly published in English. While I strove to include the majority of the most important works written in English, the coverage of similarly significant French literature is far less comprehensive; Italian, German and other European and non-European authors are mentioned less frequently. While this is a clear drawback, my hope is, as in the case of the thematic scope of the paper discussed above, that this review may provide inspiration for further regional studies, which will eventually lead to a comprehensive understanding of the past and present of historical ecology.

II The Roots of Historical Ecology

Scientific investigations of a historical ecological character appeared as early as the 18th century. In 1769, Daines Barrington proposed in the *Philosophical Transactions of the Royal Society London* the hypothesis that sweet chestnut (*Castanea sativa*) was not native to

Britain. This was followed by a debate in which field observations, ancient timber, place names and historical documents were used (summarized in Rackham, 1980). Another well-known example is the Ruined Landscape theory, which blames the current, supposedly degraded state of Mediterranean landscapes on deforestation in the past. As a scientific idea, this theory is also from the 18th century, although a similar way of thinking can be followed as far back as Dante's writings in the 14th century (Grove & Rackham, 2001). The birth of modern forestry in the 18th century was also accompanied by historical ecological considerations, once again depicting older times in an unfavourable light. While fear of future wood shortage (Warde, 2006) was perhaps the main motivation behind the works of authors such as Hans Carl von Carlowitz (1713), modern forestry has a long tradition of blaming past forest uses for later unseemly conditions (Hölzl, 2010). The first comprehensive works on forest history were also published in the 18th century, such as Stisser's (1754) *Forst und Jagd-Historie der Teutschen*. In the 19th century, many great scholars dealt with past human–nature interactions at various spatial and temporal scales. Prominent examples include for example the towering figures of Charles Darwin and Alexander von Humboldt (Bowler, 1990; Sachs, 2006). In *The Earth as Modified by Human Action* (1874), George Perkins Marsh started out with a description of the Roman Empire and identified many of the topics that still form an important part of historical ecological investigations. But not all scholars worked at such large spatial scales. For example Flóris Rómer – Benedictine monk, archaeologist and art historian – published an essay in 1860 in which, based on the examination of archival sources and place-names, he tried to reconstruct the vegetation and natural conditions of Hungary in the Middle Ages (Rómer, 1860).

In the 20th century, several scientific strands contributed to the formation of historical ecology. I identify five strands, but, given the wide interdisciplinary spectrum of contemporary historical ecology, more such strands could be distinguished, for example historical climatology (Brázdil *et al.*, 2005) or environmental archaeology (Evans & O'Connor, 1999). Some of these research directions will be mentioned later in this review in connection with the development of historical ecology from the 1960s onwards. Generally speaking, I concentrated on those strands that appear to have had the largest influence on what is nowadays called historical ecology. The following descriptions are intended as brief reminders of the importance of each strand for historical ecology rather than exhaustive summaries.

The first scientific strand is forest history. It was rapidly developing in the 19th century (e.g. Schwappach, 1886; Maury, 1867), and by the 1960s countless works were produced on all aspects of the topic (for an overview, see Agnoletti, 2006). While many authors focused on the history of forest legislation in various parts of the world, many others tried to establish causal relationships between historical human impact and later forest conditions.

The second important strand is the *Annales* school of historical method and thought. Named after the journal *Annales d'histoire économique et sociale*, founded in 1929 by Lucien Febvre and Marc Bloch in Strasbourg, the influence of this school on the development of history as an academic discipline cannot be overestimated. *Annales* historians were mainly active in promoting long-term social and economic history in opposition to traditional political history. Interpreting the study of the past in the widest possible sense (total history),

one of their many contributions was to introduce the environment (physical as well as living) as a subject of investigations in rural history (Ford, 2001; Locher & Quenet, 2009). In the early 1940s, Bloch wrote that “very few scholars can boast that they are equally well equipped to read critically a medieval charter, to interpret correctly the etymology of place-names, to date unerringly the remains of prehistoric (and historic) habitations, and to analyze the plants characteristic of a pasture, a field, or a moor. Without all these, however, how could one claim to write the history of land use?” [Bloch, 1949 (posthumous first edition), translated and quoted by Crumley, 1998, p. ix]. The most important figure of the second generation of *Annales* scholars was Fernand Braudel, whose *La Méditerranée et le monde méditerranéen à l'époque de Philippe II* (1949) emphasized the influence of the environment (in this case meaning mostly the physical environment of climate and geology) over the ‘long duration’ of history, even if Braudel’s environment was rather static. Another *Annales* historian, Emmanuel Le Roy Ladurie was among the first to study the history of climate (Le Roy Ladurie, 1967); in 1974 there appeared a special issue of the *Annales* devoted to the history of the environment.

Many ideas of the *Annales* school originated in the (historical) geography of Paul Vidal de la Blache (Claval, 1998; Ford, 2001). In general, early historical geography is the third important scientific strand in the making of historical ecology. For example Carl O. Sauer’s work on the history of cultural landscapes in the USA (e.g. Sauer, 1966) or H. C. Darby’s monumental volumes on 11th-century England (Darby, 1977) have had a lasting effect on later research directions.

The fourth scientific strand to have contributed to the forming of historical ecology is palaeoecology (the reconstruction of past biota and environments over long periods, such as the Holocene: Birks & Birks, 1980), especially palynology. Fossilized pollen was first observed and identified in the 19th century, and the first modern pollen diagram was published by Lennart von Post in Sweden in 1916 (von Post, 1916; Manten, 1967). Human activity as an ecological factor appeared early in pollen-analytical research, for example in the works of H. Godwin in the 1930s (e.g. Godwin, 1934) and in the debate concerning the Neolithic elm decline from the 1940s onwards (e.g. Iversen, 1949). Karl-Ernst Behre’s publications from the 1980s on anthropogenic indicators in pollen diagrams are still widely used (e.g. Behre, 1981).

The fifth scientific strand is landscape history/archaeology. Especially in Britain, detailed studies of local landscapes on the model of William Hoskins’ *The Making of the English Landscape* (1955) have provided inspiration for later historical ecological investigations. Influential authors in landscape archaeology, such as Michael Aston, shared many common interests with historical ecologists (e.g. Aston, 1985). In Italy, a similarly important role is attached to the work of Emilio Sereni (Moreno & Raggio, 1999). In France, the above-mentioned *Annales* school took the leading role in rural historical research (e.g. Bloch, 1931). In the USA, considerable similarities were found between the early researches of James Malin in the 1940s on the history of grassland ecosystems and the methodology of the *Annales* rural history (Swierenga, 1984).

As far as the term ‘historical ecology’ is concerned, its earliest usage known to me is in a 1940 publication by John Grainger. Grainger conducted research that would seamlessly fit into the ecological trend in current historical ecology. He compared a list of fungi in Yorkshire published in 1788 (a historical source *per se*) to his own field observations to discuss changes in the fungus population in the area. Seibert (1947) used the term ‘historical ecology’ to refer to the possible geological explanations for the variety in the *Hevea* genus in Peru. A year later, Conway (1948) provided the first definition of historical ecology in a paper that discussed von Post’s palynological work. Because of its thematic focus, her definition is closest to what is nowadays called palaeoecology, a term not nascent but largely unused in English at that time (Ager, 1963). Several more publications referred to historical ecology in the 1950s. Etter (1953) used the term in the title of a paper that described the flora, fauna and historical development of a woodlot in Missouri, USA. He studied archival sources but did not attempt to connect current ecosystem features to historical events. By contrast, Nicholls’ (1956) use of the term ‘historical ecology’ was more similar to that of Seibert’s (1947) in the sense that it discussed the non-human past (in this case past climate) as an explanatory factor for ecosystems in New Zealand. In his studies of California grasslands, Burcham (1957) was the first to explicitly connect past management (which he studied with the help of archival sources) to current ecosystem state under the heading ‘historical ecology.’

III Historical Ecology Since the 1960s

(1) Descriptions and definitions of historical ecology

In the second part of this review, I focus on the development of historical ecology since the 1960s. In order to conduct a better structured historiographic analysis, I compiled a collection of descriptions and definitions of historical ecology by various authors. Such a collection (which cannot pretend to be complete) naturally does not equal the history of historical ecology. Not all relevant authors ever used the term ‘historical ecology’ and even if so, many never described or defined it. The value of this collection of descriptions and definitions should therefore not be overestimated. It is intended at most as a heuristic device and will be used mainly in Sections IV and V. I collected 34 descriptions and definitions of historical ecology from monographs, book chapters and journal articles spanning a period of 65 years from 1948 to 2013 (Table 1). The distinction between description and definition should be noted: some authors simply described ongoing trends, while others formally defined historical ecology often aiming to delimit its boundaries and influence its research directions. Nonetheless, for the sake of simplicity henceforth I will refer to both as ‘definitions’. When compiling the list, the following guidelines were followed.

- (i) Each author is included in the list only once.
- (ii) Several authors defined historical ecology in more than one publication and published many works within the general topic of historical ecology. In such cases, I chose a representative definition, preferably the one that was most often quoted by other authors. However, I also include in parentheses the date of the first work known to me that was written based on the same methodological foundations as the definition.

- (iii) The list is ordered chronologically. In cases described in point (ii), the earliest publication served as the basis for chronological placement.
- (iv) Only works that contained original definitions were included. Those that merely quoted earlier definitions (e.g. Hayashida, 2005) were not included.
- (v) 'Ecological history' was taken to be a synonym of historical ecology, because the two terms have been used interchangeably. The only author to differentiate between them was Whitehead (1998).
- (vi) Definitions in languages other than English were translated into English. The following expressions were considered to be equivalents of historical ecology: *écologie historique*, *histoire écologique* (French), *ecologia storica* (Italian), *historische Ökologie* (German), *ecología histórica* (Spanish).

For each definition, Table 1 contains synonyms, references and category. 'Synonym' refers to expressions that were used at least once in the given publication as a free variation of historical ecology. 'References' include the number of references to those authors that are included in Table 1. In some cases references were made to the same authors but to publications not in the list. Such references were included if they referred to works with a historical ecological topic. 'Category' refers to the main trends in historical ecological research. Although current research identified three main trends (Bürgi & Gimmi, 2007; Szabó & Hédl, 2011), distinguishing between the ecological and conservation/restoration ecological trends proved to be impractical. There are indeed works whose focus is explicitly restoration (Egan & Howell, 2001). However, most ecologically focused studies mentioned conservation and restoration as the application of historical ecological knowledge and by and large the boundary between the ecological and conservation/restoration ecological trends appeared to be too fuzzy to be meaningfully applied. Inasmuch as conservation/restoration ecology is part of ecology, such approaches to historical ecology were interpreted as ecological. Thus, the two categories distinguished were E (ecology) and A (anthropology). The main difference between these categories is their overall focus (Szabó, 2010; Vellend *et al.*, 2013). 'E' includes scholars of usually natural scientific background who draw on historical sources and (sometimes) methods to understand current ecosystems better. For them humans are one, but not necessarily the most important, factor that have influenced current ecosystems. By contrast, 'A' includes authors who focus on human–nature interactions from the perspective of human society. Their ultimate goal is to understand human society as part of the natural world. For authors in the ecological trend, the historical ecology of a place completely devoid of human impact is a possible, if somewhat unlikely topic (Rackham, 1998; Rhemtulla & Mladenoff, 2007), while those in the anthropological trend would arguably not find this an exciting challenge.

Lastly, it should be mentioned that there exists an interpretation of historical ecology that is independent of all other approaches discussed herein. In a 1985 article, Daniel R. Brooks defined historical ecology as a complementary approach to evolutionary ecology that uses phylogenetic systematics as its main method (Brooks, 1985). Brooks elaborated on his definition in further publications (Brooks & McLennan, 1993), and other scientists became involved in similar research (e.g. Mayden, 1992). Nonetheless, this definition seems to be incompatible with other definitions, research agendas and methods of historical ecology

(even though evolution on the timescale of human history or prehistory cannot simply be ignored – Rackham, 2006). Authors who adhere to this version do not refer to or discuss other versions of historical ecology, and practically all definitions of historical ecology in Table 1 are silent about Brooks' approach. Therefore I consider the phylogenetic definition to be an independent sideline in the development of historical ecology and will not deal with it further here.

(2) From the 1960s to the 1980s – Europe

Self-conscious historical ecology started to develop in the 1960s. It was in this period that studies which influenced the later development of historical ecology and which are regularly quoted were published. In the USA, eminent palaeolimnologist Edward Deevey discussed the differences between “general and historical ecology” (Deevey, 1964), and initiated a historical ecological survey of the Yaxha and Sacnab basins (in Guatemala) in the early 1970s. The archaeological settlement studies in this survey were carried out by Don and Prudence Rice, and the former went on to write a PhD in ‘historical ecology’ (Rice, 1976). The team's joint article (Deevey *et al.*, 1979) is a classic study combining palaeoecological and archaeological evidence. Deevey's role in promoting historical ecology was acknowledged in 1984, when his seventieth birthday symposium was called “Topics in Historical Ecology.” His achievements are considered to be highly important by Carole L. Crumley, one of the leading figures of the anthropological trend in historical ecology (Crumley, 1998; Meyer & Crumley, 2011).

In England, probably the first major publication to combine ecological, archaeological and historical evidence was *The Making of the Broadlands* (Lambert *et al.*, 1960). The first book that explicitly defined its topic as ‘ecological history’ was Colin Tubbs' *The New Forest: An Ecological History* in 1968. This work was pioneering in connecting historical knowledge with nature conservation. According to George Peterken, Tubbs had his ideas fully formed by 1962 (Peterken, 1999). Peterken wrote a similar study on Staverton Park, Suffolk (Peterken, 1969). One of the most influential figures of historical ecology, Oliver Rackham, published his first history-based ecological study on Cambridgeshire woods in the late 1960s (Rackham, 1967). Sheail & Wells (1969) discussed the historical approach to grasslands research two years later. From the same year onwards, this group of scholars organized approximately 40 meetings of the so-called Historical Ecology Discussion Group at the Monks Wood Experimental Station in Cambridgeshire.

Historical ecology developed further in England in the 1970s. Based on a decade or so of investigations, the first major historical ecological books came out. Pollard, Hooper & Moore published their classic book *Hedges* in 1974, while Oliver Rackham's first book (*Hayley Wood: Its History and Ecology*) appeared a year later (Rackham, 1975) and his first syntheses (*Trees and Woodland in the British Landscape* and *Ancient Woodland*) in 1976 and 1980, respectively. He also published the first results of his work on the Mediterranean (Rackham, 1972), which was later summarized in two monographs (Rackham & Moody, 1996; Grove & Rackham, 2001). Peterken's first major book (*Woodland Conservation and Management*) was published in 1981. A contemporary study by Crompton & Sheail (1975) investigated animal as well as plant communities. Hooper (1974), Peterken (1975) and

Rackham (1980) described historical ecology in similar ways, which signalled the consolidation of the field in England. Sheail (1980) summarized the methodology used for handling archival evidence. A somewhat neglected figure in the development of British historical ecology is Leslie Rymer, who started historical ecological investigations based on his own palynological research (Rymer, 1974) as well as on archival and ethnographic sources (Rymer, 1976, 1977, 1979a). He was the first to discuss historical ecology from a more theoretical point of view, outlining what he called the “epistemology of historical ecology” in four short papers in the journal *Environmental Conservation* (Rymer, 1979b, c, 1980a, b).

In France, at approximately the same time, geographer Georges Bertrand proposed to write the history of the French countryside from a historical ecological point of view (Bertrand, 1975). His work formed the general introduction to the four-volume *Histoire de la France rurale*, edited by Georges Duby (Duby, 1975), another influential figure in the French *Annales* school, discussed above. Within the same tradition, Deléage & Hémery (1989) tried to connect historical ecology to ‘world ecology’ and Beck & Delort (1993) edited the volume *Pour une histoire de l’environnement*, in which mostly historians and geographers described their work in the 1980s in ‘éco-histoire’ (see also Ford, 2001; Locher & Quenet, 2009). Important works from a more anthropological point of view were also produced, which, nonetheless, drew on the *Annales* tradition (e.g. Guille-Escuret, 1989). At the end of the 1970s, Emily Russell in the USA published her PhD dissertation *Vegetational change in northern New Jersey since 1500 AD*, in which she combined palynological, botanical and archival sources (Russell, 1979). It is perhaps not altogether by accident that she had studied for a year in Paris, where, according to her own words, she had been introduced “to the residual impacts of people on the forests of France and to the idea that all forests have experienced some human impact” (Russell, 1997, p. xix). A year later American historian Lester J. Bilsky edited a volume entitled *Historical Ecology: Essays on Environment and Social Change* (Bilsky, 1980). This book was written by historians and social scientists, and with chapters like “Attitudes toward the environment in medieval society” had a distinctly historical (as opposed to ecological) flavour. Another American scholar to be influenced by the French *Annales* school is anthropologist Carole L. Crumley, whose first major historical ecological research project was set in Burgundy in France (Crumley, 1987).

(3) The 1990s – USA

The most important development of the 1990s was the increased interest (both practical and theoretical) of northern American scholars in historical ecology. By this time there was ample attention directed towards historical human–nature interactions, albeit from the perspective of historians. Environmental history, as the pertinent discipline came to be called, initially represented the political and intellectual history of the conservation movement (White, 1985). Although there had always been calls in American environmental history for a more ecological focus from Aldo Leopold’s *A Sand County Almanac* (1949) through James Malin’s grassland studies in the 1940s (Malin, 1984) to Donald Worster’s ‘agroecological perspective’ (Worster, 1990), generally speaking there was little communication between historians and ecologists until the 1990s. The realization by American ecologists of the importance of historical factors in their investigations came

relatively suddenly. To quote George Peterken: “When I worked at Harvard Forest in 1989–1990, historical studies in the USA were a novelty, but now [1999] they are burgeoning...” (Peterken, 1999, p. 520). This upsurge in interest started with Christensen’s thought-provoking paper (Christensen, 1989). His article was published together with comments by environmental historian William Cronon, who also mentioned the previous lack of ecological research on historical matters in the USA.

Many other ecologists started historically oriented investigations in this period, for example ecologist and director of Harvard Forest David R. Foster (Foster, Schoonmaker & Pickett, 1990; Foster, 2000) and plant ecologists S.T.A. Pickett (McDonnell & Pickett, 1993; Pickett, Kolasa & Jones, 1994) and Glenn Motzkin (Motzkin *et al.*, 1999). Importantly, northern American ecologists treated palaeoecological and archival sources as equally relevant and intensively interacted with local environmental historians, such as William Cronon. Meanwhile in Europe, Martin Hermy initiated what was to become the Belgian school of historical ecology. At least at the beginning, his work was mostly influenced by the British historical ecology of the 1970s and 1980s (Hermy, 1992; Tack, van dem Brecht & Hermy, 1993). At the end of the decade Swiss landscape ecologist Matthias Bürgi – not least as a result of his postdoctoral stay at Harvard Forest and the University of Wisconsin – started his investigations of European forests with the methodological toolkit developed in the USA. As an example of rare intercontinental cooperation in historical ecology, he published a paper together with Emily Russell that compared changes in Swiss and American woodlands (Bürgi & Russell, 2001). In Italy, the Laboratory of Environmental Archaeology and History in Genoa aimed to follow up on Sereni’s pioneering work under the leadership of such prominent scholars as Carlo Montanari and Diego Moreno (Moreno & Montanari, 2008). Historical ecological work continued to be produced in France as well, as demonstrated for example in the works of geographer Jean-Paul Bravard (1999) or in Jean-Jacques Dubois’ ‘biogéographie historique’ (Dubois, 1994).

The anthropological trend in historical ecology also emerged in the 1990s in the USA. Crumley (1994) edited a ground-breaking volume that set the direction for future research. In addition to anthropological case studies, this book included more theoretical pieces of writing (Winterhalder, 1994) as well as what is probably the most insightful analysis of the practical problems of cooperation between scholars on either side of the sciences–humanities divide (Ingerson, 1994). Subsequently, William Balée established himself as the other leading figure of the anthropological trend in historical ecology. Balée produced the most comprehensive theoretical writings on historical ecology (Balée, 1998*b*, and especially 2006) and edited a volume that could be seen as the continuation of Crumley’s 1994 book (Balée, 1998*a*). This work also included several theoretical discussions on historical ecology (e.g. Whitehead, 1998). Crumley and Balée together edit the *Historical Ecology Series* at Columbia University Press and the *New Frontiers in Historical Ecology* series at Left Coast Press. Although the works of both Crumley and Balée reflect the holistic view of Boasian anthropology (Darnell, 1998), they stem from somewhat different traditions. While Crumley’s background is archaeology, ecology and geology, Balée, with training in ethnobotany and ethnography, approached historical ecology from the perspective of human ecology. Balée’s work brought a historical focus to ethnography, replacing the time-static aspects of earlier ethnographic work and of cultural/human ecology. The anthropological

trend of historical ecology is also strongly connected to European and northern American environmental archaeology. The major influence of Brothwell & Higgs' (1963) *Science in Archaeology* shows how firmly rooted environmental topics already were in that discipline. Geographer/archaeologist Karl Butzer wrote several books that further transformed archaeological thinking towards a more ecological perspective in northern America (Butzer, 1971, 1982). A significant contribution of the anthropological branch to historical ecology in general has been its wide geographical focus, including hitherto neglected territories, such as the neotropics. It should be noted that similar research exists in Europe as well, especially in German speaking areas, where it forms part of human ecology (Winiwarter & Wilfing, 2002 – for an explicit connection of the two trends, see Bürgi, 2008). In England, social anthropologists James Fairhead and Melissa Leach published an influential book on the history of western African savannas and forests that combined the anthropological approach with methods of landscape history (Fairhead & Leach, 1996). It is perhaps justified to note that scholars' different approaches to historical ecology are to a certain extent due to differences in the material available, rather than to differences in their philosophies and methodologies. The initial focus of European historical ecology on written material was certainly facilitated by the exceptional richness of European archives. By contrast, the ethnographic method must be dominant in areas where traditional oral culture has been prevalent.

A further direction in historical ecology appeared at the turn of the millennium. Even though the connection between nature conservation and historical ecology was, as I argued above, present in England already in the 1960s, research that emphasized the applied side of historical ecology became a dominant force in the late 1990s in the USA. The publication by Swetnam, Allen & Betancourt (1999) entitled “Applied historical ecology: using the past to manage for the future” is by far the most often quoted of all papers that include a definition of historical ecology. Two years later, Dave Egan and Evelyn A. Howell co-edited a book in which 23 northern American authors provided theoretical and pragmatic advice on types of historical evidence with the purpose to create a “restorationist's guide to reference ecosystems” (Egan & Howell, 2001).

(4) Since 2000 – globalization

In the past 15 years historical ecology has become more diversified and globalized. Many researchers in various parts of the world have contributed to the theoretical debate on historical ecological research. In Australia, ecologists Ian Lunt and Peter Spooner illustrated five historical ecology postulates with local examples in order to explain patterns in biodiversity (Lunt & Spooner, 2005). Bowman did much the same in a guest editorial in the *Journal of Biogeography*, although instead of historical ecology he used the expression ‘environmental history’ (Bowman, 2001). In France, Marage and his colleagues examined parts of the Jura Mountains and emphasized the role of interdisciplinarity in historical ecology (Marage, Jaccotey & Puertas, 2001). The present author started his woodland historical investigations in East-Central Europe in the mid-2000s, which included several theory-oriented papers as well (Szabó, 2005, 2010; Szabó & Hédli, 2011). In addition to geographical diversification, the range of topics has also broadened. While in the 20th century historical ecology for the most part focused on the interactions between humans and

vegetation (usually forests), recently zoologists have also begun to contribute. Although zooarchaeology has a tradition spanning more than a century (Landon, 2005) and has been part of standard archaeological practice since at least the mid-20th century (Brothwell & Higgs, 1963), it was only exceptionally viewed as part of historical ecology (but see Beaufort, 1987). This appears to have changed in the past decade. For example Fitzpatrick & Keegan (2007) emphasized the importance of archaeological faunal assemblages in historical ecology. Stahl (2008) discussed in detail the connections between zooarchaeology and historical ecology, and Rick & Lockwood (2013) coined the term ‘conservation archeobiology’ which they proposed to include in a broad definition of historical ecology. Furthermore, historical ecological theory also contributed to discussions on global environmental change (Vellend *et al.*, 2013). A brand new research trend tries to involve historical ecological data in ecosystem modelling (Gimmi & Bugmann, 2013), which inevitably leads towards global models.

Despite diversification, there are signs that historical ecology has started a process of unification. While especially in the 1980s and 1990s it was relatively common to find the use of the terms ‘environmental history’ and ‘landscape history’ as synonyms for historical ecology, this practically disappeared by 2000 (Table 1). Furthermore, historical ecologists have become more aware of each other, and this awareness now includes scholars from both trends of historical ecological research (ecology and anthropology). Fig. 1 shows that until the 1990s most works defining historical ecology did not include references to any other author in Table 1, and if so, only to those in the same research trend. Since the 1990s this has changed and in the past 15 years the majority of papers quoted works by researchers both in the ecological and anthropological trends of historical ecology. The same general trajectory towards globalization and unification was demonstrated in the first international conference of historical ecologists, organized by Matthias Bürgi at the Swiss Federal Institute of Forest, Snow and Landscape Research in 2011. At this conference the four main topics were the connections between historical ecology and (i) global environmental change, (ii) general patterns of ecosystem change, (iii) ecosystem modelling and (iv) environmental history/archaeology.

The period since 2000 brought a sudden rise in the number of publications that identified themselves as historical ecology. Fig. 2 illustrates this trend based on the two most widely used citation databases. I searched for the term ‘historical ecology’ in ‘topic’ and ‘title’ in Thomson Reuters’ *Web of Science*, and in ‘title, topic and keyword’ in Elsevier’s much larger *Scopus* database (date of query: 15.11.2013). Excluding the year 2013, I found 374 and 962 publications, respectively. In the *Web of Science* database, 76% of all records were published after 2000, whereas *Scopus* showed 87% for the same variable. Although even a basic summary of the most important research topics would exceed the limits of this review and is not my primary aim, a list of some topics is included here to illustrate the diversity of current historical ecological research. I emphasize that such research is not necessarily new; the novel aspect is often the growing awareness of and identification with historical ecology. Woodland historical ecology as established in England in the 1960s has grown in strength. In particular, the ancient woodland indicator species concept has been adapted in many regions including Poland (Dzwonko & Loster, 1989), Germany (Wulf, 1997), Belgium (Bossuyt, Hermy & Deckers, 1999) or Denmark (Petersen, 1994), and a European overview was

published (Hermy *et al.*, 1999). Subsequently the reactions of plant species to land-use change were studied (e.g. Verheyen *et al.*, 1999), which, based on life-history traits, was applied on a global scale as well (Verheyen *et al.*, 2003). The connection between plant ecology and archaeology is especially strong in France, where strikingly long-term legacies of previous land-use were demonstrated (e.g. Dupouey *et al.*, 2002). Historical ecologists in Europe and northern America also actively cooperate with palaeoecologists in the study of those periods for which palaeoecological and archival evidence are both available (Jamrichová *et al.*, 2013; Ireland, Oswald & Foster, 2011). In the USA, archival sources, especially lists of witness trees, were used to create large databases in order to reconstruct pre-European settlement vegetation (e.g. Cogbill, Burk & Motzkin, 2002). Narrative written sources were used for the same purposes in Australia (Jurskis, 2011). Historical ecological research was also produced in Spain (Valladares, 2004; Buxó, 2006) and southern America (López & Ospina, 2008). A highly significant area of historical ecological research is meadow vegetation. Meadows are the *par excellence* semi-natural vegetation. Their species richness as well as their importance for humans, which resulted in large amounts of detailed written sources from the Middle Ages onwards, make them a favourite subject in historical ecology (e.g. Eriksson, Cousins & Bruun, 2002; Poschlod & WallisDeVries, 2002). As far as aquatic ecosystems are concerned, both marine (e.g. Nadon *et al.*, 2012; McClenachan & Kittinger, 2013) and freshwater (e.g. Zu Ermgassen *et al.*, 2012; Haidvogel *et al.*, 2013) environments are intensely studied. The traditional interest in the history of predators and large mammals has continued and expanded to new continents (Oates & Rees, 2013). Historical ecology has progressed on an epistemological level as well. New and significant concepts emerged, such as the historical range of variability or extinction debt. The former replaced the earlier ‘baseline conditions’ concept to provide a dynamic background against which to evaluate current ecosystems and restoration efforts (Morgan *et al.*, 1994; Keane *et al.*, 2009). The latter describes extinctions that are inevitable through habitat loss but are temporarily delayed by the longevity of individual organisms (Kuussaari *et al.*, 2009). New types of historical sources have also been identified and examined, such as anecdotes (short narrative accounts) (Al-Abdulrazzak *et al.*, 2012) and oral history (Bürgi, Gimmi & Stuber, 2013). Arguably the most significant methodological innovation in recent historical ecology has been the creation of larger databases and their use in modelling various temporal scenarios [see e.g. Iverson & McKenzie (2013) and further articles in the 2013 special issue of *Landscape Ecology*, dedicated to “Integrating historical ecology and ecological modeling”]. At the same time, the anthropological trend in historical ecology has gone from strength to strength and now investigates regions as far apart as the Pyrenees, Tanzania and Amazonia and a wide range of topics from malaria through pastoralism to landesque capital (Vaccaro & Beltran, 2010; Håkansson & Widgren, 2014; Schaaf, 2011; Cormier, 2011; Bauer, 2004).

IV The Two Main Trends of Historical Ecology

The analysis of the development of historical ecology showed that the ecological trend predated the anthropological one (Table 1). Even though the first ‘anthropological’ definition was published in 1975 (Bertrand, 1975), and Crumley’s early work was from the 1980s, the anthropological trend in historical ecology became fully established only in the 1990s

through the efforts of Balée and Crumley. Over approximately the same period the usage of the term ‘historical ecology’ to denote the work of historians on environmental topics (e.g. in the USA: Bilsky, 1980; Hungary: R. Várkonyi & Kósa, 1993; Czech Republic: Purš, 1988; Germany: Leidinger, 1986) disappeared (but see France: Clément, 2011). Such research nowadays forms part of environmental history, a well-established subfield of history all over the world with its own journals and university departments studying topics ranging from the ecological effects of colonialism through fire history to the history of pollution (e.g. Grove, 1996; Pyne, 1997; Brimblecombe, 1987). Table 1 demonstrates that in addition to being the older of the two trends, ecology also dominates in descriptions and definitions of historical ecology. Out of 34 definitions 26 are ‘ecological’ and only eight ‘anthropological.’

When examining the interconnectedness of the two main trends, it is apparent that ‘anthropologists’ are more aware of ‘ecological’ work in historical ecology than *vice versa*, although this may be to a certain extent the consequence of the relatively later formation of the anthropological trend. It is nonetheless worth noticing that out of the 26 papers containing ‘ecological’ definitions of historical ecology 20 (77%) quoted other ‘ecological’ definitions but only eight (31%) ‘anthropological’ ones. By contrast, from among the eight papers defining historical ecology from an anthropological point of view six (75%) contained references to both ‘ecological’ and ‘anthropological’ authors and definitions.

V The Future of Historical Ecology

In the following, I try to summarize those features that are common to the majority of existing definitions of historical ecology (see also Bürgi & Gimmi, 2007).

- (i) Almost all authors referred to human–nature interactions in the past. In other words, they emphasized the interconnectedness of humans and nature as well as the fact that influences and feedback mechanisms are active in both directions.
- (ii) Most authors acknowledged the importance of archival as well as natural scientific sources of data, and by implication the role of interdisciplinarity in historical ecology. It appears that crossing the divide between the ‘two cultures’ of humanities and natural sciences (Snow, 1959) is an integral part of historical ecology.
- (iii) Most authors mentioned the practical application of historical ecological knowledge in the conservation and restoration of both natural and cultural heritage. For some it is a central tenet, the *raison d’être* of historical ecology, while others see it as a possibility, but this is mostly a matter of emphasis.
- (iv) All authors agreed that historical ecology studies particular patterns, events and processes in the past to understand the present. Because the production and preservation of past data (both archival and natural scientific) is accidental (although naturally not completely random), historical ecological research is limited by source availability and is essentially inductive.

The question remains whether this intellectual common ground will direct historical ecology towards the formation of a recognizable scientific discipline. Two features observed in the 21st century might indicate upcoming changes. Firstly, the striking increase in the number of publications (that is, publications that identify themselves as historical ecology) is a clear sign of the inclination of the scientific community to do historical ecology, however it is defined. Secondly, as described above, the interconnectedness of individual researchers and trends in all parts of the world is growing. This is reflected in recent definitions as well. Authors increasingly noted the existence of various trends (e.g. Bürgi & Gimmi, 2007; Vellend *et al.*, 2013; Szabó & Hédli, 2011), and some explicitly mentioned their intention to advocate a broad definition of historical ecology that covers all trends (e.g. Bürgi & Gimmi, 2007; Moreno & Montanari, 2008; Rick & Lockwood, 2013). This may induce a process of systematization and institutionalization of historical ecology. However, it is equally possible that historical ecology remains – as far as academic disciplines are concerned – an umbrella term. Significantly, at the 2011 international conference on historical ecology mentioned above, the establishment of neither a journal nor a society for historical ecology found much support among those present. Being an umbrella term would preserve the current flexibility of historical ecology, which could continue to attract scholars with diverse academic backgrounds without increasing disciplinary rivalry.

A challenge emerging from recent comprehensive definitions of historical ecology which will need to be tackled in the future is the meaning of the word ‘history’ itself in the given context (Wiens *et al.*, 2012; Girel, 2006). ‘History’ can refer to the past as such, the human past or that part of the human past for which written records exist. In the first and second cases, the temporal scope of historical ecology overlaps with palaeoecology, which appears to be undesirable. On the other hand, palaeoecological methods are increasingly applied in the study of recent periods as well (e.g. Ireland *et al.*, 2011). It would then appear logical to separate ‘historical ecology’ and ‘palaeoecology’ on the basis of their source material rather than temporal scope. However, most historical ecological investigations are interdisciplinary and combine various types of data, which makes it increasingly difficult to draw a dividing line between palaeoecology and historical ecology and offers no easy way out of terminological contradictions. Notably, since approximately 2000 several authors advocated a definition of historical ecology that included palaeoecology and environmental archaeology as well (Swetnam *et al.*, 1999; Marage *et al.*, 2001; Fitzpatrick & Keegan, 2007; Meyer & Crumley, 2011; Rick & Lockwood, 2013). When viewed as part of a longer process, it seems that ‘history’ in historical ecology originally referred to the study of written sources (as in England in the 1970s and 1980s), in other words what would equal history as an academic discipline. With the increasingly interdisciplinary focus of historical ecological investigations, the meaning of ‘history’ has recently shifted towards a more comprehensive meaning including all periods and sources from the past.

It is decidedly not my intention here to choose the ‘right’ definition of historical ecology from among those that exist. I cannot but agree with Alice E. Ingerson (1994, p. 44) in that “new definitions imposed by fiat simply create a new, smaller ‘speech community’ of people who accept those peculiar definitions, within an otherwise unchanged larger community of speech and action.” Historical ecology has gone a long way from its beginnings more than

two centuries ago to those dozens of publications that appear yearly nowadays. Where it is heading will be, in the end, decided by historical ecologists themselves.

VI Conclusions

- (1) The first scientific investigations of a historical ecological character appeared as early as the 18th century, while in the 20th century at least five important scientific strands contributed to its development: forest history, the *Annales* school of historical method and thought, early historical geography, palaeoecology and landscape history/archaeology.
- (2) The history of historical ecology since the 1960s can be divided into three main periods. European (mostly British) research dominated the development of this field of study from the 1960s to the 1980s. This was followed by an increased interest in historical ecology in the USA in the 1990s. In the 21st century, historical ecology has become more globalized. The number of publications that identified their topic as historical ecology has grown sharply and so has the geographical range of research.
- (3) Out of the two main trends in historical ecological research, the ecological approach appeared earlier than the anthropological one and it is noteworthy that scholars in the latter trend are more aware of work in the former than *vice versa*.
- (4) Several features are common to most definitions of historical ecology. These include the interconnectedness of nature and human culture, the role of interdisciplinarity, the importance of applied historical ecology and identifying historical ecological research as an inductive process. Such features may provide the intellectual basis for the formation of historical ecology as an established academic discipline, and a trend towards unification is also apparent in recent, more comprehensive definitions of historical ecology. However, it is equally possible, and arguably not any less desirable, that historical ecology will remain an umbrella term.

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Fig. 1. Number of references in papers describing and defining historical ecology to other authors in Table 1 based on whether individual authors quoted others in the ecological (E) or anthropological (A) trend of historical ecological research. Data are grouped into three periods that correspond to the main phases in the development of historical ecology.

Fig. 2.
Number of papers that defined themselves as ‘historical ecology’ in the *Web of Science* (WoS) and *Scopus* databases from 1975 to 2012.

Table 1

Descriptions and definitions of historical ecology. 'Synonym' refers to terms that were used at least once as free variation of historical ecology in the given text. 'Category' is the two main trends in historical ecology: E, ecology and A, anthropology. 'References' include the number of references to other authors in the list. Where an author defined historical ecology in more than one publication, a representative definition is provided, with the date of the first work sourced that used the same methodological foundations provided in square brackets.

Author and date	Definition	Synonym	References to E	References to A	Category
1. Conway (1948)	"The post-glacial history of climate and vegetation [forms] an important part of what we may call 'historical ecology' ... Ecologists in this century have been fully alive to the value of the historical approach in the study of vegetation. Not only do we think always in terms of the dynamic ideas that derive from the successional doctrines of Clements, but we have come increasingly to recognize the profound effects that man has exerted on vegetation at any time during the post-glacial period."	-	-	-	E
2. Rackham (1980) [Rackham, 1967]	"Historical ecology seeks to interpret the natural and artificial factors that have influenced the development of an area of vegetation to its present state."	-	2	-	E
3. Tubbs (1968)	"[T]he history of human land use, management and exploitation, and the economic factors governing them, forms a coherent framework within which to describe the development of the range of habitats which comprise the landscape; for arriving at conclusions about the parts currently played by biotic and anthropogenic factors in the dynamics of habitats; for focusing the closest attention on the economic structure of agricultural and other practices from which such factors arise; and for arriving at conclusions about the history, present status and future of individual species of our fauna and flora... The previous history of change is ... important in discerning what processes are at work at the present time, and in deciding precisely how to manage or control them... [M]ost of the archaeological, historical and biological information ... can be most usefully organised under the heading of ecological history."	-	-	-	E
4. Peterken (1975) [Peterken, 1969]	Historical ecology is "a process of understanding which considers events in the past and the passage of time to be significant ecological factors. Its methodology consists essentially of discovering how a site came to be as it is."	-	1	-	E
5. Hooper (1974)	"Historical ecology is ... the art, science, craft or mystery of elucidating the present patterns of organisms in the light of man's past activities."	-	1	-	E
6. Bertrand (1975)	"[For] an ecological study of historical purpose ... above all we must persuade historians, ecologists and geographers to open a new field of thinking and interdisciplinary investigation. This process requires the development of a specific method, or at least the establishment of a number of principles... Historical ecological problems can be broken down into four levels of resolution: the study of natural environments as they currently are, that is to say substantially modified by human societies... the study of natural fluctuations of certain elements of the natural environment interpreted in isolation, the study of the fluctuations of the natural environment due to human interventions, the study of the dialectical relationship between the development of rural societies and changing environments ... in all its complexity." [translation mine]	-	-	-	A
7. Russell (1997) [Russell, 1979]	"Historical ecology seeks to explain many enigmatic features of present ecosystems and landscapes by deciphering the legacies of past human activities... By integrating [various] sources, a historical ecologist can piece together a picture of past activities and	-	2	1	E

Author and date	Definition	Synonym	References to E	References to A	Category
	communities in order to formulate and test hypotheses about causes of past changes and the contributions of past processes to present ecosystems and landscapes."				
8. Rymer (1979 <i>b</i>)	Historical ecology is the "reconstruction [and interpretation] of past environments ... based on discovering surviving relics of those environments."	environmental history	-	-	E
9. Moreno & Montanari (2008) [Moreno <i>et al.</i> , 1982]	"Historical ecology proceeds with a regressive approach, from the observation of present environmental features to those that have preceded - and thus also determined - them. Therefore, it has to handle a wide range of evidence ranging from ... oral history to field work ..., archival sources and ... sedimentary sources." [translation mine]	-	2	-	E
10. Crumley (2007) [Crumley, 1987]	"Historical ecology traces the complex relationships between our species and the planet we live on, charted over the long term... Historical ecologists take a holistic, practical, and dialectical perspective on environmental change and on the practice of interdisciplinary research. They draw on a broad spectrum of evidence from the biological and physical sciences, ecology, and the social sciences and humanities. As a whole, this information forms a picture of human-environment relations over time in a particular geographic location. The goal of historical ecologists is to use scientific knowledge in conjunction with local knowledge to make effective and equitable management decisions."	-	2	1	A
11. Christensen (1989)	Historical ecology is "a new area of ecological research ..., [which studies] the consequences of past historical events for the current structure and function of ecosystems... Historical ecology [is also] a predictive endeavor."	landscape history	2	-	E
12. Deléage & Hémery (1989)	"Any historical ecological approach therefore must interpret the relationships between human populations and their environment from an evolutionary perspective, and consider the different temporal scales of the functioning of social ecosystems, the mechanisms that provide stability and the processes that, by contrast, lead to the degradation of ecological foundations." [translation mine]	-	-	-	A
13. Foster (2000) [Foster <i>et al.</i> , 1990]	"Retrospective studies enable us to study ecological processes that are missed or underappreciated by standard field and experimental approaches... [T]hey enhance our ability to understand the many factors that have shaped and continue to condition ecosystem structure, function and composition... [Historical ecology is the] integration of history and modern ecology ... [in order to] develop a deeper appreciation for the importance of cultural and natural history in our current and future landscapes."	landscape history	-	-	E
14. Hermy (1992)	"Historical ecology seeks to understand the present composition, structure and distribution of forests using historical data sources."	-	2	-	E
15. Winterhalder (1994)	"Historical ecology undertakes the temporal (diachronic) analysis of living ecological systems that in principle is necessary to analyze their structural and functional properties fully ... [It represents] an epistemological commitment to the temporal dimension in ecological analysis."	-	-	-	E
16. Pickett <i>et al.</i> (1994)	"Historical ecology can be used to forecast future responses of ecological systems, and to explain or to forecast spatial differences in system structure or function. Historical ecology is becoming increasingly important, especially as the role of people and civilizations in the past is becoming better understood."	-	1	-	E
17. Balée (2006) [Balée, 1998 <i>b</i>]	"Historical ecology is a research program concerned with the interactions through time between societies and environments and the consequences of these interactions for understanding the formation of contemporary and past cultures and landscapes."	-	5	1	A

Author and date	Definition	Synonym	References to E	References to A	Category
18. Whitehead (1998)	"[A] fully 'historical' ecology [implies] that such a style of reasoning about ecology should put persons, not organic systems, at the center of explanations of changing ecological relationships through time."	-	1	2	A
19. Bürgi & Gimmi (2007) [Bürgi, 1998]	Historical ecology is "the study of human impacts on ecosystems and landscapes over time."	-	7	2	E
20. Swetnam <i>et al.</i> (1999)	"Historical ecology encompasses all of the data, techniques, and perspectives from paleoecology, land use history, ... long-term ecological research, ... time series from instrument-based observations of the environment, ... and data from satellites ... [through which] meaningful information can be gained about changes in populations, ecosystem structures, disturbance frequencies, process rates, trends, periodicities, and other dynamical behaviors."	environmental history	4	-	E
21. Egan & Howell (2001)	Historical ecology is "a restorationist's guide to reference ecosystems."	-	2	2	E
22. Marage <i>et al.</i> (2001)	"Historical ecology [is] an interdisciplinary approach [integrating] palynology, ... archaeology ... and archival studies' ... [which] places the conservation of cultural heritage at the same level as that of natural heritage, inasmuch as the joint study of these two heritages allows us to define the complex interactions that take place in the formation and maintaining of biodiversity." [translation mine]	-	-	-	E
23. Gragson (2005)	"Historical ecology is one of the ascendant views in ecological and environmental anthropology... [It aims] to place human decision-making, and the consciousness that drives it, at the center of our analyses of the human-environmental relationship."	-	5	3	A
24. Lunt & Spooner (2005)	Historical ecology is "a new paradigm in which ecologists view ecosystems as <i>historically</i> and spatially influenced non-equilibrium systems that are complex and open to human inputs." [emphasis in original]	-	3	2	E
25. Szabó & Hédli (2011) [Szabó, 2005]	"[H]istorical ecology focuses on past ecosystems and usually regards humans as one of the many factors that influence such systems... Historical ecology is closely linked to conservation biology and restoration ecology."	-	7	2	E
26. Grossinger <i>et al.</i> (2007)	Historical ecology is "a historical understanding of local and regional ecological patterns."	-	2	-	E
27. Fitzpatrick & Keegan (2007)	Historical ecology "combines palaeoecology, archaeological investigation, land use history, and more recent long-term (decadal) ecological research, to help examine the 'life history' of a region."	-	1	2	E
28. Rhemtulla & Mladenoff (2007)	Historical ecology includes "any research that examines the changes in and interactions among ecosystem patterns and processes through time: the history of an ecosystem. Such changes more often than not include anthropogenic effects, but these do not always need to be explicitly considered."	-	3	1	E
29. Stahl (2008)	"Historical ecology has emerged along with other contemporary ecologies as a framework for reinvigorating a neofunctional ecological anthropology that failed to adopt a diachronic perspective. The language of the latter dichotomized culture and nature and emphasized that humans adapted to the fixed environmental circumstances in which they found themselves. In contrast, historical ecology focuses on the cultural and historical production of landscapes which shape cultural experience by retaining the material manifestations of human action."	-	2	2	A
30. Jackson & Hobbs (2009)	Historical ecology is "knowledge of the state of the original ecosystem and what happened to it."	palaeoecology	2	-	E

Author and date	Definition	Synonym	References to E	References to A	Category
31. Meyer & Crumley (2011)	"Historical ecology is a cluster of concepts that offers a holistic, practical perspective to the study of environmental change. It may be applied to spatial and temporal frames at any resolution, but finds particularly rich data sources at what is loosely termed the 'landscape' scale—where human activity and biophysical systems interact and archaeological, historical, and ethnographic records are plentiful. The term assumes a definition of ecology that includes humans as a component of all ecosystems, and a definition of history that encompasses both the history of the Earth system as well as the social and physical past of our species."	-	1	2	A
32. Vellend <i>et al.</i> (2013)	"The term 'historical ecology' has been adopted by two main groups of researchers: biologists drawing on historical methods and explanations for ecological phenomena, which may or may not involve anthropogenic factors, and social scientists drawing on ecological principles to better understand human history... [W]e note that the two groups frequently share overlapping goals."	-	4	-	E
33. Rick & Lockwood (2013)	Historical ecology is "the use of historic and prehistoric data (e.g., paleobiological, archeological, historical) to understand ancient and modern ecosystems, often with the goal of providing context for contemporary conservation. A fundamental goal of historical ecology is to understand past and present human-environment interactions, but it is also concerned with understanding natural variation before and after human arrival."	-	6	3	E
34. Gimmi & Bugmann (2013)	Historical ecology can be defined as "the scientific attempts to elucidate the past of ecosystems... [Historical ecology] aims at uncovering past ecosystem dynamics and their drivers, using and combining a large variety of historical data sources."	-	2	-	E