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### Historical Ecology and Longitudinal Research Strategies around Lake Mývatn Iceland

Thomas McGovern  
*CUNY Hunter College*

George Hambrecht  
*University of Maryland*

Megan Hicks  
*CUNY Hunter College*

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Title: **Historical Ecology and Longitudinal Research Strategies around Lake Mývatn Iceland**

**Authors:** Thomas H McGovern, George Hambrecht, Megan Hicks

**Abstract:** Historical Ecology has proven to be a very influential tool kit for thinking about complex human interactions with changing landscapes, climate, and other humans. It has also provided concrete and practical frameworks for carrying out sustained long- term place-based research projects that break through traditional periodization to look at the dialectical interaction of human economies and local and regional ecosystems through time. The “longitudinal perspective” pioneered by Carole Crumley’s work in Burgundy has proved to be a very effective tool for carrying out sustained multi-year, multi-investigator, and multi- generational investigations in landscapes around the globe. This paper presents an overview of the application of a longitudinal historical ecology research agenda to the Mývatn high altitude lake basin in Northern Iceland and the often-unexpected outcomes resulting from decades long investigation of millennial scale processes in the same research area by expanding teams of researchers that include the local residents.

**Keywords:** Historical Ecology, Longitudinal Research Strategies, NABO, Carole Crumley

In 1990 Carole Crumley invited a group of both established and early career researchers, including a very junior Thomas McGovern, to a memorable *School of American Research* seminar in Santa Fe NM. The result was the core volume *Historical Ecology* (Crumley 1994) that launched all that followed in the cascading developments of the HE interdisciplinary tool kit that has expanded, evolved, and grown beyond what any of us could have expected back in the last century (Balée 1998, 2006, Balée & Eriksson 2006). Historical Ecology now informs a host of projects ranging from digital model building to restoration and conservation efforts, to field projects all over the globe, and shows huge vitality as new generations step forward to embrace and expand the initial formulation (see Armstrong et al 2017, Crumley 2012). Carole’s impact in archaeology was already notable in 1990, with innovative landscape-scaled investigations in Burgundy and beyond, heterarchies contesting hierarchies in multiple settings, and vigorous and sustained collaborative field work projects. She forcefully advocated for a “*Longitudinal*” research strategy that focused on a region and its landscapes changing through time and invested significant resources and multiple seasons on returning to the same area to better understand long term human ecodynamics. Since her official retirement, her efforts on behalf of the *Integrated History and Future of People on Earth* (IHOPE, <http://ihopenet.org/> ) have had a major impact on the key theme raised at the original 1990 workshop- the vital importance of the perspectives of the *longue durée* in current attempts to secure a better and more sustainable future. Her career path has been hugely influential, and her continued “overtime” work as an *emerita* provides role models for both early career and increasingly ancient scholars participating in the Historical Ecology agenda.

This paper (prepared by a mix of early career and ancients) offers a perspective on the sustained application of Carole’s *Longitudinal* strategy to the inland lake basin of Mývatn (midge lake) in northern Iceland carried out by the *North Atlantic Biocultural Organization* research and education cooperative since 1996 ([www.nabohome.org](http://www.nabohome.org)). The Mývatn basin in north Iceland is 50-80 km from the sea and lies about 280m above sea level. It represents one of the highest continually occupied parts of Iceland and farming has centered on grass and hay production for domestic animal fodder, though limited barley production may have taken place in the Viking Age settlement period (Ogilvie,1991, 2001; Ogilvie et al., 2015 ). The region today combines agriculture with a booming tourist industry, and is a long-term center

for environmental activism. It has also been the center of sustained archaeological and environmental science investigations for over a century. These sustained “longitudinal” investigations have produced a fully landscape-scaled perspective on human settlement and land use in this part of Iceland that has been greatly aided by widespread volcanic ash deposits (tephra) and a host of AMS C14 dates provided as part of a coordinated program aimed at better understanding what proved to be a freshwater carbon reservoir effect (Ascough et al 2007 et seq.; Brown 2010, Dugmore et al. 2004, 2007, 2014; Dugmore & Newton 2012; Jones et al. 2012; Lawson et al. 2005 et seq. McGovern et al., 2006, 2007, McGovern et al. 2014,2017; Simpson et al. 2001, 2004; Streeter et al. 2015; Vésteinsson, 2008 ; Hicks, 2014; Hicks et al. 2016; Sigurðardóttir et al., 2016; see also field reports on [www.nabohome.org](http://www.nabohome.org) ).

Archaeological research in the Mývatn region began with survey and excavation work by Daniel Bruun and Finnur Jónsson at the site of Hofstaðir in 1908 (Bruun and Jónsson, 1909, 1910, 1911). Recent work began in 1992 the Mývatn region with a small project centered on the Hofstaðir ruin led by *Fornleifastofnun Íslands* (the Institute of Archaeology, Iceland) who invited in the teams of the *North Atlantic Biocultural Organization* (NABO) research and education cooperative when it became clear that this site had considerable remaining research potential for re-investigation using modern excavation techniques and a full spectrum of environmental specialists (Lucas 2009).

This new work provided an opportunity not only to try out new techniques but also to use the large open area excavation as the centre piece for an international field school (begun in 1996) that attracted students from multiple disciplines (saga scholars to hard scientists) from North America, Europe, China, Japan, and (importantly) Iceland. This international crew provided many opportunities for two-way learning, and in retrospect this multi-year field school had a major impact on the development of the once-marginal North Atlantic into a “hot” research area for Historical Ecology and Human Ecodynamics research (McGovern 2012).

While the work at Hofstaðir continued, survey work around the lake was turning up multiple sites with excellent organic preservation and early tephra associations, suggesting that much remained to be learned as we expanded the excavation and environmental sampling program. Collaborators from U Stirling in Geoarchaeology, from U Mass Boston in geophysical prospecting, from U Edinburgh in tephra and geomorphology, pollen and macrofloral experts from U St Andrews and U Durham, isotopic researchers from U Glasgow and the Scottish Univ. Environmental Research Centre all spread out over the region digging geo-trenches, coring lakes and bogs, investigating charcoal pits, and building up a multi-year, multi-stranded understanding of human interactions with landscape, climate, and resources that could fuel high resolution modelling (Ascough et al. 2007, Colquhoun et al. 2010; Dugmore & Newton 2004, Simpson et al 2004; Thomson & Simpson 2007). All this research was provided with invaluable help and excellent hospitality by Dr Árni Einarsson of the long-established *Mývatn Science Station* (<http://www.ramy.is>) of the University of Iceland. Trained as a biologist, Arni’s skill at reading landscape (from both the ground and air) and keen eye for cultural traces has made him an all-time high scorer in locating new archaeological sites in the region, ranging from extensive early earthworks to some of the most productive midden sites in the area (Einarsson 2015). The combination of informed local expertise with international collaborators has proved incredibly productive, and these strong professional and personal bonds are also not easily forged over a few project seasons.

While the international field school was attracting groups of diverse twenty-something grad students to Mývatn, and the landscape was increasingly swarming with specialists and survey teams, we also had a

chance to hear from the local Icelandic residents about their own past and current natural and social environment. It turned out that they had a great deal to contribute, from oral histories to troves of unpublished photos and manuscripts- and a host of detailed place names that clearly connected to the medieval and Viking age landscapes. The region has a long history of engagement between local and traditional knowledge and the evolving Western scientific disciplines, and hand-copied translations of Marx and other European intellectuals as well as debates on evolution and agricultural improvement circulated widely in manuscript in the 19<sup>th</sup> century. With this tradition of active self-organization, it should not have been surprising that local residents began making use of these non-avian seasonal migrants, and some warm friendships and real collaborative partnerships grew up as the project seasons rolled on. These connections went from *ad hoc* Land rover repair help to extended co-production of knowledge with resident scholars of local and traditional knowledge and folklore (Sigurðardóttir et al 2018, Hartman et al. 2017).

Notably the local schools and local heritage activists organized a *Kids Archaeology Project Iceland* and (later) a *Seniors Archaeology Project Iceland* which both brought school groups into the field with our teams in summer and launched a program of using GPS and digital recordings to capture rapidly fading place name evidence and associated tales and legends in collaboration with the Icelandic Place Names Institute and the Icelandic Geodetic survey and the local Husavík Museum. We were able to facilitate this work by providing first simple GPS receivers and small digital cameras and then integrated iPad tech to engage students and elders. An NSF research experience for undergraduates (REU) grant to Dr. Sophia Perdikaris (then CUNY Brooklyn College now U Nebraska) brought groups of NYC inner city undergrads to Iceland, and their interaction with the KAPI students, local scholars, and the international science teams proved genuinely transformative (on many sides). Some of the REU participants are now in doctoral programs, but the majority are high school science teachers who regularly use their Icelandic experiences in the urban classroom. The long -term connection with Iceland and Mývatn thus works on both sides of the Atlantic. Dr Perdikaris was able to provide mobility support so that Mývatn activists could visit Orkney in Scotland and Barbuda in the Caribbean and make direct contact with other local level school and community led initiatives combining archaeology, heritage, and environmental science with place-based education and education for sustainability. These webs of connection have proven very productive, and again are only possible with a sustained multi-year effort on all sides.

In the archaeology, major excavations at the sites of Hofstaðir, Hrísheimar, Sveigakót, and Skútustaðir have been combined with smaller-scale surveys and testing at sites across the lake basin, and have produced a fully landscape-scaled perspective on human settlement and land use in this part of Iceland that has been greatly aided by widespread volcanic ash deposits (tephra) and a host of AMS C14 dates provided as part of a coordinated program aimed at better understanding what proved to be a freshwater carbon reservoir effect (Ascough et al 2007 et seq. McGovern et al., 2007, 2017; Vésteinsson, 2008 ; Hicks, 2014; Hicks et al. 2016; Hartman et al. 2016, Sigurðardóttir et al., 2016; see also field reports on [www.nabohome.org](http://www.nabohome.org) ).

The unusually complete archaeological record for the Mývatn area indicates that initial Norse settlement in the late 9<sup>th</sup> century was unexpectedly rapid with settlement spreading across the basin following the deposit of the Landnám (877 ± 1) tephra layer and before the fall of the V-Sv (938 ± 6) tephra (Batt et al 2016, Schmid et al., 2017). It appears that multiple sites in both prime farm land and more marginal locations were occupied within the first generation, with clear implications for the overall

rate and scale of the settlement of Iceland (Vésteinsson and McGovern, 2012). We still have a lot to learn about the Viking Age in the North Atlantic (Vésteinsson & Gestsdóttir 2015).

Another unexpected finding was the documentation of a remarkable millennial scale sustainable harvest of migratory waterfowl eggs by the local community. Mývatn is famous in biology as the only place where tens of thousands of migratory waterfowl from both hemispheres come together to nest and lay eggs. Ethnographic accounts from the 19<sup>th</sup> century and the 20<sup>th</sup> century systematic records of the Science Station reveal that local people were able to regularly harvest 10,000 or more eggs per year without impacting the waterfowl populations. The basic rule has been to not kill adult birds and leave enough eggs in each nest to prevent abandonment (while suppressing arctic fox and controlling domestic dogs and pigs). The well dated Mývatn archaeological deposits extending back to the first settlement layers ca. 877 CE have produced masses of egg shell (now demonstrated by Scanning Electron Microscopy to largely come from waterfowl) but few adult bird bones (Hicks et al 2016, Brewington & Hicks 2015). This case is becoming widely known as a solid example of successful bottom-up community management of inherently fragile natural resources on the millennial scale. This combination of bioscience, archaeology, and traditional and local knowledge is also a result of long term commitment and many sustained conversations across multiple boundaries (Hicks, 2014; Hicks et al. 2016; Sigurðardóttir et al., 2016)

Hofstaðir itself provided continued surprises: the zooarchaeology clearly indicated that this was a working farm, but also turned up evidence of dramatic beheading of cattle and display of bucrania around the great hall (Lucas & McGovern 2008). An early Christian family cemetery probably holding the remains of closely related Mývatn residents from ca. 1000-1300 CE provided another sustained excavation program led by Hildur Gestsdóttir, and is now subject to multiple studies using osteology, dental morphology, stable isotopes, ancient DNA and the zooarchaeology of an archaeofauna ca.1300 which shows evidence of resilient response to cooling climate in the Middle Ages (Gestsdóttir 2014, Price & Gestsdóttir 2006). The monograph edited by Gavin Lucas (2009) pulls together the sustained effort at the Viking age great hall and serves to underline the sobering fact that had we undertaken a “standard 3 years and out” project we would have been seriously wrong about much of the story of this site and region.

There is sound science behind the idea of a long- term commitment to a research region. There are also excellent rewards on many different levels for pursuing the Longitudinal pathway, and Carole’s influence has been felt far from the vineyards and fields of Burgundy. Iceland today is seeing the creation of similar long -term research areas in Svalbardshreppur, Eyjafjörður, Skagafjörður, and in the West Fjords by similarly international and interdisciplinary teams also taking the long term longitudinal perspective to connect past to present and future.

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