The Eclipse of History?

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Can history tell us anything useful in a world undergoing rapid environmental change, where the future will be unlike the past? This question is at the heart of an ongoing debate among ecologists and resource managers. For example, hydrologists and water managers have based their work for decades on the assumption of stationarity – the notion that natural systems fluctuate within an unchanging window of variability. This assumption established a framework for managing water supplies, regulating floodplain development, and evaluating flood risks. The magnitude of recent and projected anthropogenic and climate-induced changes in river basins and streamflows, however, has led some scientists to declare that the concept is no longer useful, that "stationarity is dead" (Milly et al. 2008).

Similarly, foresters have relied on assessing the "historical range of variation" to establish targets for managing forests with respect to fire or harvesting practices, for example, and the concept is included in planning directives for the United States Forest Service. Yet some scientists and managers are now asking whether the concept and guidelines are irrelevant in the face of climate change. They argue that, as species disappear or shift distributions and biotas mix, we are likely to experience "no-analog" futures – assemblages of species unlike any we have seen before (Fox 2007). In such a world, knowing how things have varied in the past may provide little guidance about how they will be in the future.

If history can't help us manage proactively, does this mean that history is irrelevant? Certainly not! The problem is not with history, but with the use of history to establish targets or

"desired conditions" for management. This is how stationarity and historical range of variation have been used. In other contexts, the target of ecological restoration is usually a return to some previous, more natural, condition, and the laws governing the assessment of damages from environmental accidents in the United States define recovery as a return to what the status of a species would have been had the accident not occurred. Past history is used to provide the reference criteria for management or restoration.

Such approaches recognize that natural systems are not static, that variation in time is a property of nature. Yet they all express, in one way or another, adherence to a balance-of-nature perspective. While acknowledging that nature varies from year to year, the window of variation over many years is assumed to be fixed. The shorter the time period considered (the smaller the window), the smaller the range of variation. Because most ecological studies are constrained to last only a few years by the realities of grant cycles (or the imperative for graduate students to complete their degrees), the range of natural variation that one sees is often small. It is easy to regard this variation as background noise, something to be removed through statistical analysis.

If the window is expanded, however, more of the real variability of nature emerges, and we begin to see more extreme events. If the window is large enough (say, many decades or a century or two), it becomes apparent that the "historical range of variation" is anything but stable. Using an even larger window on history, paleoecology has shown us time and again that the current distributions of species and composition of communities were very different in the past. Paleoclimatology and paleontology indicate that climates in the distant past may have approximated those predicted to develop over the next century, although the species and biological communities were entirely different (they were "no-analog pasts"). Clearly, our

perception of stability (“stationarity”) in natural variation is a figment of using an unrealistically narrow window on the past.

So what does this say about the relevance of history to ecology? Even if we acknowledge that ecological systems are not in steady-state equilibrium and that the range of variation has itself varied in the past, how will this help us to understand or predict how these systems may vary in a no-analog future?

We can begin by recognizing that the future is contingent on the present. The pathways into the future are constrained by where we are now – which species are present in an area, which land uses are dominant, how landscapes are connected or fragmented. But the present is contingent on the past – on history. What we see now when we look at nature bears the legacies of past species’ distributions, the ghosts of past species interactions, the impacts of extreme events that may have occurred centuries ago, and the fingerprints of human alterations of landscapes that happened in past millennia. The sorts of changes in climate or disturbance that have recently pushed some systems across thresholds into alternative states undoubtedly occurred in the past, setting trajectories of change that have led to what we see today. History determines a distinctly nonrandom range of possibilities, from which the present has emerged.

Historical ecology can also help us to understand how ecological systems came to be as they are. It can reveal which species have persisted and which have not, and which attributes characterize the survivors or the losers. It can show us how systems have responded to extreme events, which the climate modelers tell us are likely to become more extreme and more frequent in the future. It can tell us something about past patterns of colonization, adaptation, and extinction associated with past climate changes. It can provide the information needed to test models of the future – if a model can’t “backcast” the past (about which we know something),

how confident can we be about its forecasts of the future? And all of this can contribute to a better understanding of the determinants of ecological resiliency, which will be critical to the sustainability of ecological systems in a rapidly changing future.

It has been said that those who ignore history are condemned to repeat it. Given the changes now underway, it's unlikely that we'll be repeating anything that has occurred in the past. It's also true, however, that those who ignore history cannot benefit from its lessons. Historical ecology can help us deal with the future through a better understanding of the past.

As frameworks for setting fixed targets for management or restoration, Stationarity and historical range of variation, if not dead, should at least be eclipsed, relegated to obscurity. But history? History lives on. It's what got us here, and it's what will set our pathways into a different and uncertain future.

References

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