

PERSPECTIVE: IS EVERYTHING A NOVEL ECOSYSTEM? IF SO, DO WE NEED THE CONCEPT?

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In Chapters 5 and 6 of this volume the authors wrestled with the precise definition of novel ecosystems. They found that while they could fashion a rough-and-ready discrete definition, with which one could categorize any ecosystem as novel or not novel, a more accurate representation of reality called for a continuous space, with areas exhibiting degrees of novelty. That a continuum best models the concept of novel ecosystems – that its boundaries are not clear lines but gray areas – raises the possibility that a novel ecosystem may not be a distinct entity. We explore that possibility here. In doing so, we find that many instinctively appealing definitions, upon careful consideration, turn out to apply to the whole planet.

If a novel ecosystem must be changed from its historical range of species composition or ecosystem processes, then there are very few natural landscapes that would not qualify as a novel ecosystem. No ecosystem on Earth is the same as it was 12,000 years ago and most have changed much more recently (Jackson 2006; see also Chapter 7); change is an inherent prop-

erty of ecosystems. Human influence is omnipresent, from land-use change to climate change (Ellis 2011).

The degree to which a specific piece of land is under active management or subject to human intelligence – another potential criteria for a novel ecosystem – is clearly a continuous variable. Lands which we might be tempted to disqualify from the category ‘novel ecosystem’ on the basis of some nominal amount of management may be much more self-directed than such hyper-managed spaces as an Iowa cornfield. Grazing land may be used only for the occasional grazing of livestock, which may or may not closely replicate the grazing regime of displaced herbivores. What of the person who camps in the novel forest? Is she ‘using’ or ‘managing’ the ecosystem as she roasts weenies over her fire? This vagueness works the other way as well. ‘Unmanaged’ spaces are seldom if ever really uninfluenced by human activities. Areas never used directly for agriculture or settlements may still be used for hunting or spangled with species transported by humans. Even a forest that is never visited by humans

may burn or not burn in the dry season due to large-scale fire prevention efforts, regional land use and so on. No ecosystem is an island, even islands. It is clear that the seeming absence of local human influence is an illusion on a planet undergoing rapid anthropogenic change. There might be some meaningful threshold beyond which an ecosystem becomes a novel ecosystem, but it is almost impossible to determine what that threshold should be. By these criteria, then, no systems are 0% novel. Is every organism, landscape or water body on Earth now part of a novel ecosystem?

Before we go on, we must stop to acknowledge that not everyone agrees that concepts have to be mutually exclusive or watertight in order to describe real entities or in order to be useful. Philosophers of science, in particular, have accepted vagueness and pluralistic definitions for scientific concepts. In the debate over the species concept, given the endless problems biologists and philosophers face pursuing a universal definition, some reject the reality of the category of species but many others accept cluster concepts, a plurality of definitions or are prepared to wait for a better, tighter definition to arrive some day in the future (Ereshefsky 2010).

In addition, we could conceive of the novel ecosystem concept as a tool. The phrase “boundary object” (Kueffer 2011) refers to a concept that is used by different groups in subtly different ways, “at the same time powerful enough to structure conceptual thinking and ‘soft’ or adaptive enough to allow flexible use by different groups of people”.

Despite these perfectly good options for reconciling ourselves to the imperfect definitions of novel ecosystems so far proposed, we maintain that the tendency of the category to take over the entire planet is instructive. Perhaps it is the case that simplistic definitions tend to categorize the whole Earth as a novel ecosystem because the whole Earth is a novel ecosystem: a creation of anthropogenic change under varying levels of day-to-day management, a global garden with some corners gone feral and others planted in neat rows (Ellis 2011; Marris 2011; Steffen et al. 2011). For the purpose of this chapter, we will assume that everything is a novel ecosystem. Given this assumption, is the concept still useful?

‘Novel ecosystems’ is by no means the first descriptor of landscapes to face accusations of meaninglessness. Many have pointed out that if human beings are considered natural, then so are all their works and one

finds that ‘nature’ has expanded to cover the entire universe. ‘Wilderness’ has in recent decades come under fire for describing a mirage: a land that has never been touched by human hands (Cronon 1996; Sörlin 2011). Yet ‘nature’ and ‘wilderness’ are still widely used terms. We want some terms to differentiate places not simply out of a joy of categorization, but because we value different places differently. Conservationists have used ‘nature’ and ‘wilderness’ to describe places they like: places to be protected and revered.

The proponents of the ‘novel ecosystem’ concept have a similar motivation. They seek to rebrand lands currently described by ecologists as ‘degraded’ or, less formally, as ‘trash’ so that some such lands can come to be valued. Or, as Mascaro et al. write in Chapter 5 on the origins of a novel ecosystem, “It is important that we appreciate that we are living in a changing world and that societal restoration norms of systems with historical species composition may not be a suitable or even possible future intervention target.” With such an aim, it is perhaps no problem that the concept ‘novel ecosystem’ may be as meaninglessly broad as ‘nature’ when rigorously examined. Its purpose is not to describe certain places as they are, but to color our emotional reaction to certain places in order to make us see possibilities were we formerly only saw failure. Thus the concept may well be useful as a cultural idea or, to put it more bluntly, as a propaganda tool.

If that is the case, then a day should come when the term is no longer needed. Imagine a summer field season many years from now where young ecologists hike through forests and scramble up steep mountain meadows, identifying plants and animals, measuring leaf litter and tree diameters at breast height and honestly enjoying the beauty of the scene, despite the fact that all the species around them are far outside their historical ranges. With all of the ecosystems of their experience having similarly high degrees of change, would these future ecologists think of the landscape that surrounds them as a ‘novel ecosystem’ or just an ecosystem?

That day may be long in coming. Despite a broad realization in ecology that all ecosystems are dynamic and, by now, at least somewhat anthropogenic, conservationists and the public at large still cling to the comforting vision of the single historically correct timeless wilderness paradise. In many introductory environmental science courses, *A Sand County Almanac* is assigned as the gospel of conservation. Beautiful and elegantly written, it is hard to argue against its status

as the greatest work on the subject; on the finer points of ecology, however, is it woefully outdated. Leopold notes that “Paleontology offers abundant evidence that wilderness maintained itself for immensely long periods; that its component species were rarely lost, neither did they get out of hand”. He also describes wilderness as “the most perfect norm”, “a base datum of normality; a picture of how healthy land maintains itself as an *organism*” (emphasis added).

At the time of publication in 1949, these statements were in step with prevailing ecology theory. Clementsian succession and the organismal ‘climax’ view of ecosystems reigned, and the recent past ecologically was viewed as stoic and rarely changing. Over the next half century, however, a steady stream of discoveries reversed these views. The super-organism model collapsed with a new understanding of how species moved during periods of environmental change (Davis 1981; Jackson 2006), and accounts of one-sided and pre-human ‘biological invasions’ surfaced (Vermeij 2005). It seemed that component species were often lost, and frequently got out of hand.

Lest it strike you as terribly unfair to argue that a 60-year-old text is, well, old, consider the modern dialogue in conservation and ecological restoration, which is just beginning to pound idly at its Clementsian shackles. Editorial boards are being dragged kicking and screaming into even minute concessions to historical efficacy. One recent high-profile review took the tellingly timid step of arguing that restoration projects might benefit from relaxing strict adherence to the historical *relative abundances* of native species (‘restoration through reassembly’; Funk et al. 2008). This study envisions restoration projects only within the outlines of historical composition, but allows the relative abundances of natives to deviate from historical levels in an effort to produce a stable system. Despite its very minor relaxations of the strict goal of historical fidelity, one colleague of the second author called this study “splashy”, as though the field of Restoration Ecology was conceding that it cannot produce a perfectly historically accurate ecosystem. Another paper suggested that some ecological restorations might benefit from non-native species, which in many instances help recover basic ecosystem functions such as productivity and nutrient cycling (Ewel and Putz 2004). A different colleague felt this paper should not have been published. Fredrick Clements would doubtless find each of these papers abhorrent. But why do some modern ecologists feel the same way?

And then there are practical matters. Ultimately, accepting that all ecosystems are novel means chucking out a single shared goal – historical fidelity – that was supposed to have optimally provided everything we might have wanted out of an ecosystem, from beauty to resilience to function to services to wildness. When that goal is no longer tenable, or is reduced to a minor category of lands managed for museum-style pedagogic values or as shelters for precarious endangered species, then we, collectively, have to decide on management goals for every piece of land. Specific ecosystem management strategies (which can broadly be divided into the categories of protection, restoration or development) will now ideally be decided on within a specific landscape in proportion to their ability to offer local, regional and global stakeholders the opportunity to add to the values and services of multifunctional landscapes. Decisions should hinge on factors such as the human system context (economics, culture, institutions) within which a particular ecosystem was embedded, its suitability (relative productivity per unit development and maintenance cost) for providing these values and the opportunity costs induced by not using the ecosystem for some other use.

Hashing out all these uses will not be easy, as any veteran of stakeholder processes knows. If the day comes when historical fidelity is usurped as the default goal for every landscape, we can imagine grizzled old ecologists reminiscing about a time when conservationists, at least, were all on the same page: *put it back the way it used to be*. By then, however, society will have realized that this is an option for only a few boutique restoration jobs. Everyone will be looking forward instead, trying to balance all the potential values to be gained from every acre. Restoration, which began as a retrospective enterprise, will have become wholly prospective.

Modern restorationists will doubtless view this as a pessimistic future, but we believe that intensive use will not always win the day if values such as biodiversity, recreation and beauty still have adherents. There will also be options on the table previously not considered. One relatively new value that will have to fight it out with all the others will be ‘undirected succession’, or the value of letting an area ‘go wild’ and seeing what becomes of it. Here will be our strongholds of Nature with a capital N, our new wildernesses. Leopold said that “wilderness is a resource that can shrink but not grow”. However, the novel ecosystems concept helps describe a future in which a new and expanding

wilderness is indeed possible and even likely. The unfolding of natural processes – whatever the level of human interference – seems to be the engine of nature.

Until this day, when ‘novel ecosystems’ have disappeared into ‘nature’ because the set of landscapes and seascapes that qualify as novel ecosystems is ultimately seen to exactly match the set of landscapes and seascapes that qualify as nature, we believe the term still has utility. In science, the novel ecosystems framework can help embolden restoration ecologists to use new tools and new goals, and shake off the yoke of history. It can also be a useful descriptor for a certain kind of landscape, a shorthand that lacks the negative connotation of terms such as ‘trash ecosystem’. In policy, the concept can create a space for incentivizing the protection of spaces currently regarded as trash. Appropriately deployed, it may even be able to create monetary value for huge swathes of the undeveloped Earth. In the culture more broadly, the concept *may* be useful to teach a certain affluent outdoorsy demographic not to automatically despise and undervalue ecosystems altered by past human activity (and thus spiral into a black hole of despair from which no checks to conservation organizations can escape). But, whether ‘novel ecosystem’ is the right brand for this education process is up for debate. The term has a jargon feel, and doesn’t tap into terms which already inspire warm emotions in the outdoorsy public. Brands which include connotations of wilderness, such as ‘the new wild’, might be more appealing. After all, ‘historically correct’ ecosystems are no longer wild, as they require ever more intensive management as they are prevented from adapting to changing conditions. Novel ecosystems are the new center of undirected evolution and wildness.

It is interesting to speculate who will grow out of the novel ecosystem concept first. Will restorationists (by then, presumably called ‘ecosystem designers’) learn to manage each landscape for forward-looking goals without regard to historical composition? Will policy-makers come to value all ecosystems according to metrics divorced from historical composition? Will the public learn to love weeds?

Change among professional ecologists and restorationists could happen in a teaching environment; over time, historical systems visited by students will look less and less like they did to their mentors. Novelty will lose visible context to people, at which point we will simply be living in a new normal of rapidly changing

ecosystems. In such a normal, what is the point of talking about categorical designations?

We have argued that the novel ecosystem concept is a useful transitional concept, even if rigorous attempts at definition cause it to balloon to unhelpful proportions. There is a counterargument that using the novel ecosystems concept even as a bridge for just a few decades is dangerous, as the existence of the category implies the existence of its opposite. This reinforces the notion that there is or can be some static, pristine alternative to novel ecosystems and thus perpetuates the very myths of ecosystem stasis and ‘untouched wilderness’ it seeks to uproot. If there is a ‘novel’ ecosystem, then there must be an ‘old’ or ‘normal’ or ‘unchanged’ ecosystem out there somewhere, right?

Whatever the past, today we live in a biosphere governed by human legacy and design. Humans have altered everything, and there is no going back. Our hope is that the novel ecosystems concept will help us understand this reality. Time will tell how useful we find the term, and for how long, as we learn to be conscious managers to our rapidly changing planet.

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