CONSERVATION BIOLOGY

Is Embracing Change Our Best Bet?

David Moreno Mateos

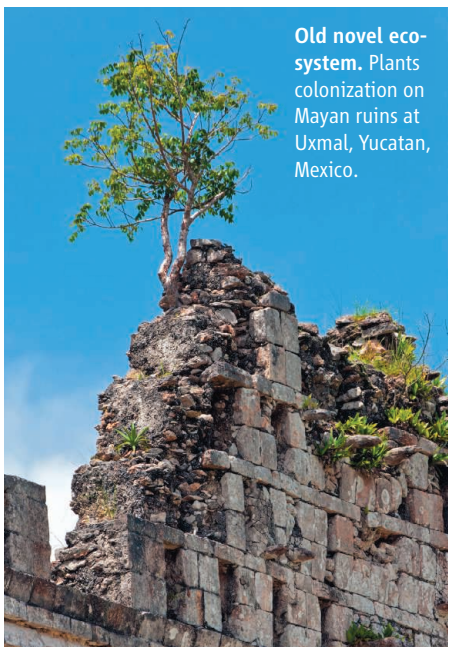
Restoration ecology and conservation biology are both under pressure to adapt to accelerated anthropogenic global change. Pristine areas free from human influence no longer exist and, arguably, have not for thousands of years (*1*). Major land-cover transformations for agriculture affected vast territories more than 3000 years ago (*2*). Large mammal extinctions in the late Pleistocene (circa 12,000 years ago) were related to human expansion (*3*). And relocation of now-widespread naturalized species was already happening 4230 years ago, when domestic dogs (dingos) were introduced into Australia by way of southeast Asia (*4*). Thus, human-sculpted landscapes are what we have been mostly managing for millennia. Because the rate of alteration has dramatically increased over the past 200 years, those ancient localized impacts now affect most of the world. Additionally, other indirect impacts act at a planetary scale—e.g., increased carbon dioxide concentration and nitrogen deposition.

Since the late 19th century, conservationists have sought to preserve habitats, populations, and species from further degradation or reduction. Since the 1980s, practitioners of ecological restoration have tried to assist damaged ecosystems with recovering from human impacts (*5*). In the face of massive anthropogenic change, ecologists and ecosystem managers frequently struggle to study and to manage such amounts of change, and neither conservation biology nor restoration ecology, in their current forms, provides sufficient conceptual basis or all the tools necessary to move forward (*6*). In *Novel Ecosystems*, editors Richard Hobbs, Eric Higgs, and Carol Hall and their contributors present theory and case studies to support an alternative approach to addressing human-induced change in ecosystems around the world. Anthropogenic change is not inherently bad, they argue. It should be accepted and managed in ways that increase ecosystem functionality and, in turn, increase ecosystem services provided to humans. The editors define the titular "novel ecosystems," introduced in (*7*), as "systems that differ in composition and/or function from present and past systems as a consequence of changing species distributions, environmental alteration through climate and land use change and shifting values about nature and ecosystems."

Novel Ecosystems
Intervening in the New Ecological World Order

by Richard J. Hobbs, Eric S. Higgs, and Carol M. Hall, Eds.

Wiley-Blackwell, Oxford, 2013. 380 pp. $79.95, £45, €53.90. ISBN 9781118354223.



Old novel ecosystem. Plants colonization on Mayan ruins at Uxmal, Yucatan, Mexico.

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The volume includes well-documented examples that highlight how nonnative species appear to contribute, at least over short time scales, to the conservation of native endangered species. At present, both the endangered Rodrigues fody (*Foudia flavicans*) on Rodrigues Island and the Carnaby's cockatoo (*Calyptorhynchus latirostris*) in southwestern Australia rely on seeds of invasive trees. Introduced species assemblages may also play important functional roles. On Rodrigues Island, the Aldabra giant tortoise (*Aldabrachelys gigantea*) imported from the Seychelles feeds on native and nonnative plants, replacing the recently extinct endemic tortoises and bringing back herbivory. Several contributors claim that after the "original" (i.e., roughly pre-Anthropocene) species composition is lost, functionality, at least, may be recovered through nonnative species. These authors suggest that ecologists and managers reassess their value-laden perceptions of heavily altered, degraded, or invaded ecosystems and potentially embrace such systems as a "new normal" that may help provide valued services to humans.

The authors of the chapter on a conceptual framework hold that novel ecosystems differ from other ecosystems because human activities have pushed them across ecological thresholds to a new state where they "do not depend on human intervention for their maintenance." Threshold crossings can be provoked by anthropogenic environmental changes and by socioeconomical or political circumstances. The authors identify as "hybrid" those ecosystems that combine characteristics of both novel and historical systems because they have suffered substantial alteration but have not yet crossed a putative ecological threshold. They propose that these thresholds provide tools for ecosystem management. For hybrid ecosystems, managers should work to dampen or reverse drivers causing the shift. They may be able to restore, at least partially, historical species configurations. However, once the threshold is crossed, the historical biodiversity and functionality of the system are lost. In which case, managers should focus on maximizing functionality in the novel ecosystem.

Unfortunately, threshold crossings are only occasionally reported in the scientific literature. Because they are driven by a variety of causes and may take decades or centuries to exhibit detectable symptoms, they are difficult to recognize. So it seems unlikely that highly uncertain, trial and error–based protocols for detecting threshold crossings will soon be embraced by already-burdened ecosystem managers. At present, these thresholds look more like theoretical constructs than practical management tools. However, the volume highlights the urgent need to further develop their potential.

The editors and contributors acknowledge that change "is an inherent property of ecosystems" and that today all ecosystems are directly or indirectly influenced by human activities. Thus, the term novel ecosystem essentially refers to any ecosystem, which suggests that we can dispense with its use. Also, because nothing is permanently new and, according to the authors, novel ecosystems perpetuate themselves, the term is conceptually contradictory. Commenting on the scope of the concept, Emma Marris, Joseph Mascaro, and Erle Ellis justify its relevance because of its practical value for ecosystem management as a "propaganda tool"—a means "to rebrand lands currently described by ecologists as 'degraded.'" However, widespread acceptance of this simplified perspective of the concept may have two major unde-

The reviewer is at the Jasper Ridge Biological Preserve, Stanford University, Stanford, CA 94305–5020, USA. E-mail: davidmor@stanford.edu

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sired consequences. There may be perverse outcomes, similar to the results from some national mitigation policies under which further degradation of "undisturbed" wetlands is often justified by ecosystem restoration that usually delivers a less diverse and less functional state (*8*). And the term might lead to imprudent management, such as the relaxation of early detection and effective controls on biological invasions, with unpredictable outcomes.

Conservation biology and restoration ecology are changing rapidly, providing new conceptual foundations and tools for preserving or restoring biodiversity and ecosystem functionality, both of which are now considered global priorities (*9*). The disciplines need more time to mature and produce optimal solutions to our growing concerns. Although the authors' new terminology does not seem a step forward, *Novel Ecosystems* provides relevant and stimulating ideas for discussion and integration into conservation and restoration methods, strategies, and goals.

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NEUROSCIENCE

A Lifetime Without Memory

Nicholette Zeliadt

Henry Molaison had a poor memory; that much he knew. He could recognize family members and recall information he had learned in school, but he was unable to remember any new experiences, from the people he met to the places he visited and conversations he had. Any new information he encountered simply slipped from his mind within 30 seconds, the result of an experimental brain operation that arguably saved his life but robbed him of the ability to form long-term memories. Undoubtedly devastating to his daily life, his memory loss proved to be a priceless gift to neuroscience, facilitating a number of important discoveries that form the basis for much of what we now know about the biological underpinnings of learning and memory.

Known publicly only by his initials "H.M." until his death at age 82 in 2008, Molaison famously underwent surgery in 1953 in an attempt to alleviate the debilitating epileptic seizures he had experienced since childhood. The procedure (which involved removing much of his hippocampus, amygdala, and surrounding structures) dramatically curtailed his seizures but left his mind forever stranded in time. In *Permanent Present Tense*, Suzanne Corkin takes readers inside the life and mind of the man behind the initials. She provides a touching yet unsentimental glimpse of her 46-year connection to this "pleasant, engaging, docile man" and his tragedy, interests, and experience of everyday life. At the same time, Corkin skillfully uses stories about his experiences and capabilities to illustrate some of the scientific principles underlying memory. She also offers a comprehensible historical sketch of the study of memory and the burgeoning field of neuroscience—from the dubious and gruesome practice of prefrontal lobotomy to the development of powerful brain-imaging techniques.

Permanent Present Tense
The Unforgettable Life of the Amnesic Patient, H.M.
by Suzanne Corkin

Basic Books, New York, 2013. 400 pp. $28.99, C$32. ISBN 9780465031597.
Allen Lane, London. £20. ISBN 9781846142710.

Corkin, a behavioral neuroscientist at the Massachusetts Institute of Technology, began studying Molaison in 1962 while she was a psychology graduate student at McGill University. Corkin and other researchers devised clever cognitive tests to assess his memory and other intellectual abilities, and they subsequently used brain-imaging tools to precisely determine what structures were missing from his brain. Molaison's case helped to reveal that something as abstract as converting a thought or experience into a memory could be localized to a discrete part of the brain—the hippocampus.

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Happy to participate. Henry Molaison at a 1986 testing session at MIT.

Yet to everyone's surprise, Molaison sometimes was able to remember things, exquisitely described by Corkin as appearing "from time to time like driftwood washing up from an empty sea." For instance, he could learn the instructions for some of the cognitive tests that he took repeatedly and sketch the floor plan of a house that he moved into years after the onset of his amnesia. In old age, he learned to use a walker, although he had no memory of having done so. Molaison's case aided the recognition that memory is not a single process and that some skills and information could be acquired without conscious awareness.

Molaison remained a good-natured and cooperative research participant throughout his life, his keen sense of humor ever-present. For example, when asked whether he had slept well one night during a visit to the research facility, Molaison responded, "I didn't stay awake to find out." He seemed to live relatively free of the stresses and anxieties of daily life, "unencumbered by recollections from the past and speculations about the future" that prevent many of us from experiencing life in the here and now. After his death, Molaison's brain was preserved and shaved into 2401 slices for further study, and in this form, he will continue to advance our understanding of memory and the brain.

Sadly, Molaison's condition prevented him from ever fully grasping the importance of his contributions to science and humanity. Corkin's compelling account in *Permanent Present Tense* should help ensure that he will remain an unforgettable figure in the continuing saga of our quest to understand the workings of the mind.

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The reviewer was a 2010 AAAS Mass Media Fellow. E-mail: zelia001@umn.edu