

ENVIRONMENTAL STUDIES

Eden no more

The first official report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), released on May 6th in Paris, provides the first modern authoritative assessment of planetary biodiversity and related contributions of nature to people (CNP)–dubbed ecosystem services. Ecosystem services are those charities of nature, both nebulous and tangible, that serve as the backbone of human well-being: food, fresh water, clean air, wood, fiber, genetic resources, and medicine.

The IPBES is being called the IPCC of Biodiversity, with the IPCC referring to the Intergovernmental Panel on Climate Change, the recognized assembly of the United Nations created in 1988 to provide global leaders with regular scientific assessment of the implications and risks of climate change. The IPBES, founded in 2012, came slow on the heels of the IPCC for a variety of reasons but in large part because grappling with, gathering data for, and analyzing the myriad features of global biodiversity and ecosystem services are astoundingly complex endeavors.

A scientific assessment of the state of biodiversity and ecosystems services in the context of climate reveals that all are inextricably intertwined, united yet dispersed, invaluable yet monetizable, reflecting nature in its holistic role as the bedrock of human civilization. The 2005 Millennium Ecosystem Assessment served as an early appraisal of the state of life on Earth. The IPBES synthesis is today's report card, and it tells a short story: Eden is gone. While the planetary garden still exists, it is in deep disrepair, frayed and fragmented almost beyond recognition.

Not unexpectedly, the specific findings are depressing. More species are threatened with extinction than any time in human history. Ever growing human populations and their activities have severely altered 75% of the terrestrial environment, 40% of the marine environment, and 50% of streams and rivers. The health of freshwater biodiversity has been particularly neglected because freshwater is widely understood and managed more as a physical resource vital to survival rather than as the special and delicate habitat that it provides for an extraordinary array of organisms.

The primary drivers of negative trends are also no surprise: In descending order, these adverse impacts include rapid changes in land and sea use, direct exploitation of natural resources, climate change, pollution, and invasive species. Of monumental note is that, collectively, significant destructive forces arise from the actions of impoverished peoples living at the edges of society, working to eke out an existence often with little choice but to have minimal concern for environmental impact.

The role of climate change in biodiversity loss is also severely underestimated because of the lag between rising levels of CO₂ concentration and the equivalent ac-

cumulation of the radiant heat that leads to warming and biological impact. Ironically, climate change is also, in part, the consequence of biodiversity destruction: The amount of carbon in the atmosphere from degraded and destroyed ecosystems is now equal to what remains in extant ecosystems. The additional CO₂ emanating from the combustion of fossil fuels is in fact ancient solar energy that was trapped and converted by ancient ecosystems and is now being released in a geological instant.

While the IPCC reports have documented climate change and sounded warnings, the IPBES report highlights aspects of the degradation of planetary natural systems that equally warrant immediate attention and action. As dire as the findings in the assessment may be, they likely also hold the ingredients of solutions. For example, economists and decision makers are largely unaware of (or chose to ignore) the contributions of natural resources to the Gross Domestic Product (GDP) of indigenous peoples or the poor; at the same time, many of those people are often equally reluctant to embrace the monetary value of local ecosystem services. CNP and ecosystem services are essentially two congruent valuation systems, and both are recognized by the IPBES assessment. The danger is that decision makers are often distant from the actual sites of valued biodiversity and ecosystems; as a result, they do not see actual monetized benefits from the sustainable use of natural resources and so peg the value of these resources at, or near, zero.

Adding to the flaws in the calculus of conservation and sustainability is the surprising inattention to the value of new discoveries from biodiversity and ecosystems to life sciences research. For example, researchers recently discovered that a soil fungus in Nova Scotia can functionally disarm antibiotic-resistant bacteria, a discovery that could transform practices in medicine, agriculture, and beyond. About 70% of drugs used for cancer are natural or bioinspired products. The polymerase chain reaction aided by an enzyme from a Yellowstone hot spring bacterium may have generated close to a trillion dollars of benefit through rapid multiplication of genetic material. The list of treasures uncovered in the elements and processes of the natural world grows daily; at present, however, these kinds of contributions from natural resources to human health and life sciences are neither recognized nor accounted for and so are treated as free and without value.

The IPBES report findings are more than sobering: 35 of 44 assessed targets of the Sustainable Development Goals depend on authentic transformational change to reverse trends of degradation. The assessment concludes that the current course of planetary degradation can be altered only with preemptive and precautionary actions, strengthened laws and related enforcement, dramatic changes in economic and social incentives, increased



Thomas E. Lovejoy,
University Professor,
Environmental Science
and Policy, George
Mason University,
Fairfax, VA 22030, USA.
Email: tlovejoy@
unfoundation.org

Copyright © 2019
The Authors, some
rights reserved;
exclusive licensee
American Association
for the Advancement
of Science. No claim to
original U.S. Government
Works. Distributed
under a Creative
Commons Attribution
NonCommercial
License 4.0 (CC BY-NC).

monitoring of biodiversity and ecosystems, and integrated decision-making across sectors and jurisdictions.

These dramatic changes will need to be supported by leaders, who themselves must promote new ways of understanding the meaning of “quality of life,” ones that value consuming less, wasting less, conserving more, and engaging truly novel approaches to global resource conservation and management. New tools will need to include technologies, creative economic models, and future-facing patterns of social behavior that are respectful of the diversity of needs, cultures, and local resources across the planet. These tools will need to be designed and applied to manage land use, agricultural development, and resource distribution in ways that will feed everyone adequately without further destroying nature.

Happily, the publication of the IPBES assessment coincides with new and hopeful visions emerging from the conservation community that adjust the scale and impact of collective efforts upward dramatically. The Edward O. Wilson Biodiversity Foundation’s goal of Half-Earth was one of the first, with the aim of conserving half of the planet’s lands and seas to safeguard the bulk of biodiversity, including humans. The National Geographic Society has a goal to place

30% of the planet in protected areas by 2030. The Global Deal for Nature, recently published in *Science Advances* (eaaw2869, March 19/19 issue) is essentially coincident with the One Earth vision from the Leonardo DeCaprio Foundation.

The story of the unraveling of the planetary web of life has been told for decades, well before Rachel Carson’s prediction of silent springs. With its publication, the IPBES assessment, however imperfect, is now the most complete and comprehensive synthesis to date on the state of the health of the planet with all its natural resources and potential for contributing to human well-being. Readers at all levels of government, in the for-profit sector, and in civil society should heed its warnings and act on its vision and recommendations in haste. Together, we now sit at the fail-safe point and must decide what to do; collectively, all sectors must embrace the challenges raised by the assessment, rise to action, and do what we must do to ensure a viable future for our living planet and for humans and the extraordinary variety of life with which it and we are blessed.

– Thomas E. Lovejoy

Citation: T. E. Lovejoy, Eden no more. *Sci. Adv.* **5**, eaax7492 (2019).

Eden no more

Thomas E. Lovejoy

Sci Adv 5 (5), eaax7492.
DOI: 10.1126/sciadv.aax7492

ARTICLE TOOLS <http://advances.sciencemag.org/content/5/5/eaax7492>

PERMISSIONS <http://www.sciencemag.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of Service](#)

Science Advances (ISSN 2375-2548) is published by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. The title *Science Advances* is a registered trademark of AAAS.

Copyright © 2019 The Authors, some rights reserved; exclusive licensee American Association for the Advancement of Science. No claim to original U.S. Government Works. Distributed under a Creative Commons Attribution NonCommercial License 4.0 (CC BY-NC).