

ENVIRONMENTAL STUDIES

What comes next?

“Science doesn’t care what we believe. If you are on the top of a building and fall, gravity is still a thing whether you believe in it or not.”

—J. Marshall Shepherd, University of Georgia

One of the singular most important scientific questions that faces humanity in this epoch, the Anthropocene, is “*What comes next?*” In my view, the single most important area of scientific inquiry that can provide an answer to that question lies at the intersection of ecology, evolution, and environmental biology: collectively *environment*.

As the Deputy Editor for environment at *Science Advances*, some may see my claim of the scientific primacy of *environment* as a bit of professional braggadocio. But I say it is not: Were I a chemist, cosmologist, cytologist, or a researcher in any other field represented by the 18 Deputy Editors and over 200 Associate Editors who lead the journal, the expanded and modernized iteration of *Science* magazine, I would still find *environment* to be the premier area of research of the Anthropocene.

Here’s why. First, the Anthropocene itself is not characterized by people being everywhere, as the name might suggest. Instead, it is unique because it was a period of abrupt environmental change, the kind that paleoecologists of the future would measure in ice and sediment cores. Just before agriculture emerged at the end of the Holocene (11,700 years ago), virtually every environmental gauge of planetary health began rapidly shifting into the red. Since then, all measures of global health—soil nitrogen, greenhouse gas concentrations, ocean acidity, frequency and magnitude of fire, extents of natural habitats, and the diversity of life itself—have all changed so abruptly that future paleoecologists might think that an asteroid hit the planet.

Second, the dramatic pace of change is not rooted in a destructive cosmic event but rather has been borne of humanity’s *biological success*. We have risen to a population of 7.7 billion with a combined global biomass of 600 million tons of organic carbon, nearly 10-fold the mass of all wild mammals combined. Unfortunately, this *success* has come with incredible cost: to achieve it, we have been depleting most of Earth’s most precious natural capital—its best habitats, clearest freshwater, richest fisheries, abundant biodiversity, and its limited supply of life-essential elements and nutrients.

For most people, biological success matters little in comparison to *socioeconomic success*, our collective and individual well-being. Compared to our biological success, our socioeconomic success is dismal. At the low end of the socioeconomic spectrum, about 3.4 billion

people—nearly half the global population—do not make enough to meet basic needs. At the other end, high net-worth individuals—people with a million dollars or more in liquid assets—number only 16.5 million or a miniscule of 0.2% of the global population. Despite their tiny numbers, these socioeconomic winners have financial assets of over \$70 trillion, a shockingly high portion of the entire global economy of nearly \$82 trillion. In other words, one-fifth of 1% of the global population commands 87% of global wealth. The rest of the world, 99.8% of the planet’s population, must struggle to make do with what little is left.

Ecomodernists, those who believe that human prosperity can increase indefinitely and sustainably, decry the brandishing of such negative numbers, the communicative mainstay of ecorealists. Ecomodernists see ecorealists as the nabobs of numbing negativism, while ecorealists see ecomodernists as purveyors of the flimflam of unfounded optimism. I see these perspectives as neither capturing a real nor a wholly modern view of our situation. Rather, I see the Anthropocene as the proverbial worst and best of times. We are in the midst of horrific environmental change, but it is spread on a canvas of fantastic advances in science that may in fact be providing the background setting of a bright future.

Given the fervent debates between ecomodernists and ecorealists one would think that calls for the imperative to protect the environment would be rising into worldwide action in civil society, but no such uprising is happening.

Why? It is perhaps because as a species, we are so easily distracted. In a recent Gallup poll, Americans were asked what they thought were the most important problems that we face today. They answered, starting with the very worst: dissatisfaction with leadership, immigration reform, political partisanship, race relations, health care, lack of personal mutual respect, the decline of religious and family values. Finally, eighth in the line of fears and trepidation, the environment.

Public sentiments of what problems are important for our nation to address are reflected in public investments in fundamental science or lack thereof. U.S. federal funding of science is a tiny \$150 billion out of an annual budget that exceeds \$3 trillion. Worse, funding for fundamental environmental biology has been a microscopic \$145 million.

All that being said, I remain optimistic, and I do so in part because of *Science Advances*. We began accepting manuscripts in 2014 as the open-access expansion of *Science* magazine, an experiment in many ways. Since then, we had thousands of submissions come our way



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and more than 450 studies have passed our quality, rigor, and impact. This work, I hope, serves our goal to truly advance and transform the readers' view of *environment*. The papers we have published have covered an astounding range of topics, including the role of rivers in shaping bird diversity, the discovery of a major reef system at the mouth of the Amazon, evidence why some plesiosaurs survived mass extinction, hydrofracking and infant health, the evolution of pest resistance in major crops, genome mapping of wheat allergens, air pollution in China, viral life cycles in the ocean, why domestic dogs are friendly, the evolution of speech, and the formation of the Isthmus of Panama.

These advances in our understanding of all the work that inform the collective area of research on the *environmental science* also serve to deepen our appreciation of the living and strengthen the evidence for harmful environmental change, while also pointing to the promise of solutions. Much of this work is also simply way cool, garnering growing public interest as the findings we publish hit the front pages and jump to the front of multiple social media feeds.

To paraphrase meteorologist J. Marshall Shepard, science does not care what we want, what we believe, or what we consider important. Understanding how to sustain and protect our environment is a mosaic of problems that we must reckon with, whether we think it is important or not. The editors of *Science Advances* are committed to publishing rigorous and powerful environmental science, work we hope will direct, define, and draw attention to environmental problems as top priorities. We hope that rigorous, reproducible, and ethically conducted science about the environment will help change worldviews of the importance of this arena of study and, in doing so, facilitate our determining, not guessing, of *what comes next*.

–Shahid Naeem

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