

**The New York Times**

September 13, 2013

# Overpopulation Is Not the Problem

By ERLE C. ELLIS

BALTIMORE — MANY scientists believe that by transforming the earth's natural landscapes, we are undermining the very life support systems that sustain us. Like bacteria in a petri dish, our exploding numbers are reaching the limits of a finite planet, with dire consequences. Disaster looms as humans exceed the earth's natural carrying capacity. Clearly, this could not be sustainable.

This is nonsense. Even today, I hear some of my scientific colleagues repeat these and similar claims — often unchallenged. And once, I too believed them. Yet these claims demonstrate a profound misunderstanding of the ecology of human systems. The conditions that sustain humanity are not natural and never have been. Since prehistory, human populations have used technologies and engineered ecosystems to sustain populations well beyond the capabilities of unaltered “natural” ecosystems.

The evidence from archaeology is clear. Our predecessors in the genus *Homo* used social hunting strategies and tools of stone and fire to extract more sustenance from landscapes than would otherwise be possible. And, of course, *Homo sapiens* went much further, learning over generations, once their preferred big game became rare or extinct, to make use of a far broader spectrum of species. They did this by extracting more nutrients from these species by cooking and grinding them, by propagating the most useful species and by burning woodlands to enhance hunting and foraging success.

Even before the last ice age had ended, thousands of years before agriculture, hunter-gatherer societies were well established across the earth and depended increasingly on sophisticated technological strategies to sustain growing populations in landscapes long ago transformed by their ancestors.

The planet's carrying capacity for prehistoric human hunter-gatherers was probably no more than 100 million. But without their Paleolithic technologies and ways of life, the number would be far less — perhaps a few tens of millions. The rise of agriculture enabled even greater population growth requiring ever more intensive land-use practices to gain more sustenance from the same old land. At their peak, those agricultural systems might have sustained as many as three billion people in poverty on near-vegetarian diets.

The world population is now estimated at 7.2 billion. But with current industrial technologies, the Food and Agriculture Organization of the United Nations has estimated that the more than nine billion people expected by 2050 as the population nears its peak could be supported as long as necessary investments in infrastructure and conducive trade, anti-poverty and food security policies are in place. Who knows what will be possible with the technologies of the future? The important message from these rough numbers should be clear. There really is no such thing as a human carrying capacity. We are nothing at all like bacteria in a petri dish.

Why is it that highly trained natural scientists don't understand this? My experience is likely to be illustrative. Trained as a biologist, I learned the classic mathematics of population growth — that populations must have their limits and must ultimately reach a balance with their environments. Not to think so would be to misunderstand physics: there is only one earth, of course!

It was only after years of research into the ecology of agriculture in China that I reached the point where my observations forced me to see beyond my biologists' blinders. Unable to explain how populations grew for millenniums while increasing the productivity of the same land, I discovered the agricultural economist Ester Boserup, the antidote to the demographer and economist Thomas Malthus and his theory that population growth tends to outrun the food supply. Her theories of population growth as a driver of land productivity explained the data I was gathering in ways that Malthus could never do. While remaining an ecologist, I became a fellow traveler with those who directly study long-term human-environment relationships — archaeologists, geographers, environmental historians and agricultural economists.

The science of human sustenance is inherently a social science. Neither physics nor chemistry nor even biology is adequate to understand how it has been possible for one species to reshape both its own future and the destiny of an entire planet. This is the science of the Anthropocene. The idea that humans must live within the natural environmental limits of our planet denies the realities of our entire history, and most likely the future. Humans are niche creators. We transform ecosystems to sustain ourselves. This is what we do and have always done. Our planet's human-carrying capacity emerges from the capabilities of our social systems and our technologies more than from any environmental limits.

Two hundred thousand years ago we started down this path. The planet will never be the same. It is time for all of us to wake up to the limits we really face: the social and technological systems that sustain us need improvement.

There is no environmental reason for people to go hungry now or in the future. There is no need to use any more land to sustain humanity — increasing land productivity using existing technologies can boost global supplies and even leave more land for nature — a goal that is both more popular and more possible than ever.

The only limits to creating a planet that future generations will be proud of are our imaginations and our social systems. In moving toward a better Anthropocene, the environment will be what we make it.

*Erle C. Ellis is an associate professor of geography and environmental systems at the University of Maryland, Baltimore County, and a visiting associate professor at Harvard's Graduate School of Design.*

**The New York Times**

September 19, 2013

# Can the Earth Support More of Us?

**To the Editor:**

Re “[Overpopulation Is Not the Problem](#)” (Op-Ed, Sept. 14):

Erle C. Ellis recounts his transition from a narrow, distorted biological determinism regarding the challenges facing the human population to a narrow, distorted social-scientific optimism that “the only limits to creating a planet that future generations will be proud of are our imaginations and our social systems.”

Both extreme positions ignore the more complex reality that human choices interact with natural constraints.

The biology, chemistry and physics of the earth are imperfectly understood. It is not possible to predict precisely what some human choices may lead to, or whether some future environmental changes may be beyond human control. It is clear, however, that every additional billion people constrain further the choices available for life on earth, human and otherwise.

Continued rapid human population growth makes it harder and more costly to solve all our problems. The institutional, technological and behavioral innovations that have a chance of leading to the rosy future Mr. Ellis envisions will happen only with substantial effort and investment, and will be easier with slower or no population growth.

JOEL E. COHEN

DANIEL P. SCHRAG

WILLIAM C. CLARK

New York, Sept. 15, 2013

*The writers are, respectively, a professor of populations at Rockefeller and Columbia Universities, director of the Harvard Center for the Environment and director of the Sustainability Science Program at Harvard.*

**To the Editor:**

Erle C. Ellis’s thesis seems overly theoretical. Let’s examine the reality of life on earth today:

More than a billion people live below the global poverty rate of \$1.25 a day; one out of three people on earth lacks modern sanitation; nearly 800 million face water scarcity; and 18,000 children under 5 die every day from preventable causes.

We're altering the climate of the planet by pumping billions of tons of fossil fuel emissions into the air each year. The real world is already overcrowded, as thousands of plant and animal species face the threat of extinction.

Technology can certainly help meet these challenges. Instead of inventing ways to cram ever more people onto the planet, let's help provide universal access to the technological miracle of modern contraception.

JOHN SEAGER

President, Population Connection

Washington, Sept. 14, 2013

**To the Editor:**

Erle C. Ellis asserts that "there is no environmental reason for people to go hungry now or in the future." That must be comforting to the planet's billion-plus hungry people.

Mr. Ellis concludes that population growth is the mother of invention, always stimulating us to coax more food from the land: "Our planet's human-carrying capacity emerges from the capabilities of our social systems and our technologies more than from any environmental limits."

This fantasy that we can keep growing, even though Earth doesn't, recalls the economist Julian L. Simon, who also believed that human ingenuity ensured that resources would never run out.

In 1994 he wrote, "We have in our hands now ... the technology to feed, clothe and supply energy to an ever-growing population for the next seven billion years."

Paul R. Ehrlich, the author of "The Population Bomb," retorted that at current population growth rates that was unlikely: within 6,000 years, the mass of humans would equal the mass of the universe. This century, we'll reach nearly 11 billion. Averaging only half a child less per family, we'd be just 6.2 billion. Which sounds more realistic to you?

ALAN WEISMAN

Cummington, Mass., Sept. 17, 2013

*The writer is the author of the forthcoming book “Countdown: Our Last, Best Hope for a Future on Earth?”*

**To the Editor:**

Erle C. Ellis’s hopeful confidence in human ingenuity does not obviate the fact that humanity gets irreplaceable services from nature, and that we are indisputably undermining nature’s ability to provide us with those essential services.

Contrary to the impression left by Mr. Ellis’s article, nature is the ultimate source of all economic value. No commerce is possible without clean air, clean water, fertile topsoil, a chemically stable atmosphere, raw materials for food, energy and medicine, and the natural processing of wastes by the millions of species inhabiting our soil, water and air.

It is the availability of these at-risk ecological services that makes possible the technical innovations that Mr. Ellis is banking on.

ALLEN HERSHKOWITZ

New York, Sept. 14, 2013

*The writer, a senior scientist at the Natural Resources Defense Council, is a visiting scholar in sustainability at the Presidio Graduate School.*

The New York Times

## Dot Earth

ANDREW REVKIN

---

SEPTEMBER 16, 2013, 10:02 AM

### An Ecologist Explains His Contested View of Planetary Limits

By [ANDREW C. REVKIN](#)

It's no surprise that [Erle C. Ellis](#), an ecologist at the University of Maryland, Baltimore County, [faced resistance](#) when The Times published his Op-Ed article titled "[Overpopulation is Not the Problem.](#)" After all, his views clash with decades of assertions that we're in "[overshoot](#)" as a species, sucking up far more resources than the planet can continue to offer. His answer to my enduring question here — "[Which Comes First, Peak Everything or Peak us?](#)" — is the latter. *We are* different than bacteria on agar, he contends.

Ellis has [taken heat](#) before, including for his 2012 Breakthrough Institute essay, "[The Planet of No Return.](#)" In 2011, he joined Emma Marris, Peter Kareiva and Joseph Mascaro in daring to chart an optimistic environmental path for our species in "[Hope in the Age of Man.](#)"

In a guest contribution below, Ellis, a [frequent presence on Dot Earth](#), expands on the points in his Op-Ed piece hoping to clarify potential misperceptions and defend his main thesis:

#### Earth Does Not Have a Human Carrying Capacity

By Erle Ellis

In the interests of avoiding misunderstandings, I've compiled a short list of comments and responses to criticisms of my September 14, 2013 NYT Op-Ed.

**Who I am.** I am an environmental scientist (Ph.D. in plant biology from Cornell University, 1990). More about my research [here](#).

#### Why did I write this op-ed?

I did not intend this to be an op-ed about population. My goal was to correct a widespread misunderstanding about how humans sustain themselves. Aside from wild fish and a few remaining wild products, agriculture and industrial systems are the primary life support systems for humanity today. Even before agriculture, human societies required technologies and social strategies to sustain their populations well above what natural ecosystems could provide. Moreover, denser populations tend to drive increasingly productive and

efficient use of land. Scientists who study long-term human/environment relationships, such as archaeologists and environmental historians, know of this as “intensification” or “niche construction”. Some useful readings on how human populations sustain themselves in the face of population pressures:

§ Ester Boserup’s classic original work on agricultural intensification: Boserup, E. 1965. [The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure](#). London: *Allen & Unwin*.

§ A general theory of intensification processes across history: Ellis, E. C., J. O. Kaplan, D. Q. Fuller, S. Vavrus, K. Klein Goldewijk, and P. H. Verburg. 2013. Used planet: A global history. [Proceedings of the National Academy of Sciences 110:7978-7985](#) (download).

§ Niche construction/intensification in archaeology: Smith, B. D. and M. A. Zeder. 2013. The Onset of the Anthropocene. [Anthropocene](#) in press.

§ Intensification in an ancient agricultural region: Ellis, E. C. & Wang, S. M. 1997. Sustainable traditional agriculture in the Tai Lake Region of China. [Agriculture, Ecosystems & Environment, 61, 177-193](#) (download).

### **Overpopulation is not THE problem.**

Larger population sizes and rapid growth rates create greater demands on both societies and environments. Human activities can degrade the productive capacity of land (though this is not inevitable, and the opposite also occurs). However, more robust societies with greater technological capabilities fare much better with the same populations under the same environmental conditions. Societal collapses due to populations reaching “environmental limits” are not the norm (social failures and epidemic disease are; Butzer 2012. Collapse, environment, and society. [Proceedings of the National Academy of Sciences 109:3632-3639](#)). Most importantly, existing technologies could sustain current and anticipated human populations while increasingly sparing land for nature. Human well being and improved stewardship of the biosphere are limited primarily by the strength of social systems and technologies, not by population or environment. There are no panaceas, technological, social, economic or political. Nevertheless, I see no other way forward for humanity or nature but by improving our social systems and technologies. Though it will not be easy and success is not guaranteed, I am optimistic that we can continue to improve these for the benefit of both humanity and nature.

### **There are no environmental/physical limits to humanity.**



Of course our planet has limits. However the total number of people that can be supported by Earth's resources can not be predicted merely by knowing the total amount of matter or surface area on Earth.

Based on existing technological capabilities, the 9 to 10 billion humans now forecasted for this century – when human populations are expected to peak – can be sustained using existing resources. Many have speculated on how many people might be supported on Earth in theory- and huge numbers have been proposed. This is not the point- I am concerned about what the real-world limits are to human well-being and improved stewardship of the biosphere. Some readings on the theory of physical limits to humanity:

§ The classic: Cohen, J. E. 1995. Population growth and Earth's human carrying capacity. *Science* 269:341-346. Related book: Cohen, J. E. 1995. How Many People Can the Earth Support? W. W. Norton, New York.

§ Marchetti, C. 1979.  $10^{12}$ : A check on the earth-carrying capacity for man. *Energy* 4:1107-1117.

§ Franck, S., W. von Bloh, C. Müller, A. Bondeau, and B. Sakschewski. 2011. Harvesting the sun: New estimations of the maximum population of planet Earth. *Ecological Modelling* 222:2019-2026.

### **You are doing a disservice to humanity/environment.**

As a scientist, I would be doing a disservice to both humanity and the environment by not calling attention to what I see as the strongest empirical facts. I see a very high probability that humanity will sustain a population of at least 9 to 10 billion for one century or longer. However, this does not mean that humanity is doomed to “destroy the planet” or to endure a catastrophic population collapse. Given that our populations are going to be huge and sustained, it is imperative to focus not on environmental limits to populations, but on the real social and technological opportunities we have to enable both humanity and nature to thrive in the face of some very real challenges. A wide variety of natural scientists are eagerly engaging in the effort to advance the science of social-ecological systems in this effort. Further reading:

DeFries et al.. 2012. Planetary Opportunities: A Social Contract for Global Change Science to Contribute to a Sustainable Future. *BioScience* 62:603-606 ([download](#)).

### **You do not consider climate change & pollution.**

Rapid global climate change is being caused by carbon pollution, and other forms of pollution are also serious problems. Pollution is generally a tremendous costly mistake. Solutions exist to prevent and remediate almost

all forms of pollution. That they are not applied is a societal failure. Throughout history and into the future, the poor tend to suffer more for these mistakes than the wealthy. Future generations will likely look back at our time and wonder why we let these mistakes happen- especially when we knew better. However, robust societies can adapt to extreme environmental changes and I am not convinced that climate change and pollution are likely to cause societal collapse .

### **Biodiversity & mass extinctions.**

Humans have caused a number of prominent extinctions, starting before the last ice-age. Now we are causing extinctions more rapidly than ever while altering biodiversity by moving species around. Humans have already transformed ecosystems across the planet, and the rates of this transformation are increasing. Nevertheless, it is possible, though challenging, for both humanity and biodiversity to thrive in the Anthropocene. The prospects for conserving and restoring biodiversity will depend on the priorities and effectiveness of human social systems. Example:

Ausubel, J. H. 2000. The great reversal: nature's chance to restore land and sea. *Technology in Society* 22:289-301.

To me, one important element left out of this discussion of global population and resource trends is the reality that population pressures — both environmental and social — are ultimately local. My pieces since 2008 on the notion of a “[population cluster bomb](#)” go into more depth. That's why, no matter what you think of global trends, there's still great sense in sustained efforts to offer women [the knowledge and capacity to manage family size](#).

You can hear more from Ellis in this interview for [The Anthropocene Project](#) at Haus der Kulturen der Welt in Berlin by Bernd Scherer: