

Book review

The human seizure of planet Earth

David Nogués-Bravo

Dodging Extinction: Power, Food, Money, and the Future of Life on Earth
Anthony Barnosky
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Planet Earth is facing one of its most dramatic biodiversity crises, and we humans are behind it. Two hundred thousand years ago, somewhere in Africa, a new form of life arose — *Homo sapiens sapiens*. Approximately one hundred thousand years later, we left Africa, spreading across the continents to dominate and transform all ecosystems. Only now are we starting to understand our impact in the Biosphere, and to realize how our own future heavily depends on the fragile health of the planet. Species are disappearing worldwide, and in the last 500 years more than 320 vertebrate species went extinct, including iconic examples such as the dodo, the Tasmanian tiger or the Steller's sea cow. Moreover, many populations of species are already in severe decline, both vertebrate and invertebrate species.

On the shoulders of Anthony Barnosky, readers will witness the past and the current transformation of the natural world triggering, in his own words, the Sixth Mass Extinction, and how to prevent it. This paperback edition of *Dodging Extinction: Power, Food, Money, and the Future of Life on Earth* summarizes evidence, arising from a variety of research disciplines — from paleontology to economics — about the human appropriation of ecosystems worldwide, its causes and consequences. This is, in other words, the tale of the human seizure of planet Earth.

Scientists nowadays try to anticipate the future of biological diversity and how its loss will affect human societies. More than 120 years ago, HG Wells envisioned time traveling in his famous novel *The*

Time Machine. After all this time, no travel machine is, unfortunately, available to travel to the future and witness how the natural world, and us, will be doing. But fortunately, the recent juxtaposition of paleobiology, paleontology, paleoecology, climatology, genomics, global change biology, macroecology and socio-economics have paved ways to build 'time machines' for understanding how humans have eroded biological diversity in the past, and how fast biodiversity may change and disappear in the centuries to come.

In this book, readers will travel across thousands of years to learn that *sapiens sapiens* were behind the extirpation, in synergy with past climatic changes, of many large species, including iconic animals like the woolly mammoth. Later on, and after the Neolithic revolution, complex societies emerged and Romans, Mayans and other societies heavily transformed ecosystems across vast regions. And just less than two centuries ago, humankind brought on the Industrial Revolution, which for most scientists is considered the beginning of the Anthropocene, and the acceleration of the global transformation of the planet. All these aspects of the human footprint on our planet are brought by Barnosky to dissect how power, money and food through the history of our species have provoked alarming extinction dynamics.

Power, food and money are, in this book, the three nodes of the human-made vortex capturing and extirpating the diversity of life forms and the services they provide to our societies. The power of our species to sponge up large amounts of the total planetary energy likely has no precedent in the history of the planet, and it has exponentially increased in the last 50,000 years. We have since then outcompeted other forms of life and provoked their decline and extinction. This human energetic seizure of the planet is directly related to the need of modern societies to feed rapidly increasing human population sizes. The production of food, as pointed out by Barnosky, has provoked the transformation of the 33% of the lands of the planet into farms, ranches and pastures, thus accelerating the



fragmentation of habitats. These two processes jeopardize the ability of species to sustain viable populations and increase the risk of extinction events. Moreover, overhunting adds an additional pressure on species survival and readers will find a number of well selected examples, both in terrestrial and marine realms, including the critical fate of several species like whales, bluefin tuna or the Atlantic cod among others.

But transforming lands for food production or overhunting to feed our growing planetary population are not the only reasons leading to the collapse of habitats and to the decline of species worldwide. For the production of biofuels — 'green' alternatives to oil for 'feeding' our cars and many other machines — more land has been radically switched over than the area of the continental US, and some of the most diverse ecosystems of the planet, like the Cerrado forest in Brazil, are being heavily decimated to produce alternative bio-sources of energy. The author of this book is indeed well aware of these dichotomies and presents them across the text, enhancing the diagnoses of complex issues to non-specialist readers.

The third node of the extinction vortex is money. Before even ecologists and economists started to assign value to the benefits and

services provided by nature, illegal poachers, animal traffickers and a plethora of outlaws were well aware of the value of animals and plants. Parts of illegally hunted animals are sent everyday across the planet to feed traditional ‘medicinal’ markets in Asia or to ‘decorate’ homes in the western world. And other times, illegally hunted animals remain in their countries of origin. Still vivid in my mind are the images, 15 years ago in Durban, South Africa, of an open-air market where local ‘witch doctors’ were selling parts of dead animals, from hands of monkeys to undefined parts of crocodiles, shark cartilage, and a plethora of other animal remains for ‘medical’ and ‘magical’ purposes. But Barnosky does not only focus on the negative impacts of humankind in biological diversity — he also offers a wide spectrum of possible solutions to halt the loss of biological diversity and discuss their pros and cons.

Among some of the most controversial strategies to prevent the extinction of species touched upon in this book is the resurrection, using frozen fossil remains of extinct species and even of whole ecosystems. But does it make sense from a conservation point of view to bring back to life an extinct or a functionally extinct species? Take, for example, the case of the northern sub-species of the white rhinoceros. Only three individuals remain and they are not able to reproduce. A new plan using stem cells and *in vitro* reproduction has been recently proposed, but with an economic cost of several million dollars. Is it sensible to spend that amount of money to ‘resuscitate’ an individual of this sub-species, while the same threat factors, illegal hunting and habitat destruction, are still out there? Would it not be more sensible to use those economic resources to stop and to mitigate the threats, rather than bringing an already gone species back to life?

Similar arguments are made by Barnosky, and they serve to advocate caution about the potential implications of some bio-technological advancements in conservation biology. More reasonable are, in my humble opinion, many of the proposals, found throughout the book,

to halt biodiversity loss, such as more efficient food production strategies or to scale up the development of cleaner energy sources (i.e., wind turbines).

The lessons readers will extract from *Dodging Extinction: Power, Food, Money, and the Future of Life on Earth* may vary, but a clear message arises across the book: we need to re-define our relationship with planet Earth. In my view, the history of the relationship between we humans and the planet we inhabit resembles two of the main symbiotic relationships — commensalism and parasitism. From the origin of our species until the Neolithic revolution, hunter-gatherer populations were in a commensalism relationship with the planet, using the resources that were offered without damaging its global health. Later and since the inception of the agriculture and pastoralism, *sapiens sapiens* relates to the planet under the form of a parasitic relationship, benefiting to a great extent from the resources of its host, but largely reducing the biological health of the Biosphere. And now, in the Anthropocene, we may be witnessing a radical change in this relationship.

Parasitic relationships do not always finish with the death of the host, but our relationship with the natural world we know may be heading in that direction. In the same manner as some fungi are able to control the brains of ants (‘zombie ants’) for their own benefit and finally kill them, we may face the risk of manipulating the Biosphere even beyond a ‘zombie’ state and irreversibly damage it. However, we still have time to change this outcome. The book finishes with a positive message, and Barnosky urges citizens, leaders, politicians and scientists to collectively act and walk away from the Sixth Mass Extinction. I think most readers will find in this book a great journey about the relationship of our own species with the planet we inhabit, and will understand why biological diversity is collapsing and what we should do to prevent it.

Center for Macroecology, Evolution and Climate, Natural History Museum of Denmark, Universitetsparken 15, Copenhagen DK-2100, Denmark.
E-mail: dnogues@snm.ku.dk

Q & A

Gary Gorbsky

Gary Gorbsky grew up in Northeast Philadelphia. As an undergraduate he went to the College of William and Mary where he worked during the summers as a tour guide in Colonial Williamsburg. He obtained his PhD with Mal Steinberg at Princeton University, where he isolated epidermal desmosomes starting with cow noses from local slaughterhouses. For postdoctoral work he went to the University of Wisconsin to work with Gary Borisy and Hans Ris. There, he provided some of the earliest evidence for the ability of kinetochores to actively move on microtubules (the ‘Pac-Man’ model). He obtained a faculty position at the University of Virginia as assistant and associate professor, where he continued his work on mitosis. There he, his laboratory colleagues, and his collaborators first demonstrated that individual kinetochores, even sister kinetochores, showed biochemical differences during mitotic progression. They found that these kinetochore markers indicated activity of the spindle checkpoint signaling pathway, which blocks anaphase onset until chromosomes are aligned at metaphase. He moved to the University of Oklahoma as full professor and then to the Oklahoma Medical Research Foundation, where he is now Chair of the Program in Cell Cycle and Cancer Biology. There, his laboratory has provided insight into the mechanisms regulating the directionality of cell cycle progression in mitosis. Recently, the Gorbsky laboratory discovered the phenomenon of ‘cohesion fatigue’, the asynchronous separation of chromatids in cells delayed at metaphase, which may be an important contributor to chromosome instability. Gary Gorbsky also currently serves as treasurer of the American Society for Cell Biology.

What were the earliest influences on your decision to become a scientist? I grew up in a lower middle-class family. All my grandparents were immigrants to the US. However, we were the first in the neighborhood to get a color television. It was the size of