The Future *of* Nature

EDITED BY

Libby Robin, Sverker Sörlin, Paul Warde

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Documents of Global Change

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ADVANCE PRAISE FOR

The Future of Nature: Documents of Global Change:

"This representative and comprehensive collection of the original publications is no small achievement, but what makes the book really sing is the annotated commentary that sets each in its intellectual context and time *and* show how collectively they build to the understanding of today. There is absolutely no book like it."—Thomas E. Lovejoy, University Professor of Environmental Science and Policy, George Mason University

"This book, drawing primarily from a 300-year legacy of Western scientific literatures related to global thinking, gives much-needed historical context for the ongoing development of human conceptions of themselves and the whole Earth in relation to each other."—Julianne Lutz Warren, New York University

"*The Future of Nature* is a very unusual type of book as it consists of largely natural science texts edited and organized by three humanities scholars. . . . It will be extremely useful in bringing together in one volume a selection of foundational texts for the prevailing thinking about future global change."—Poul Holm, Trinity College, Dublin

"Among the greatest challenges for the anthology in the 'Age of Instant Downloads' is to offer a whole that is more than the sum of the book's disparate selections. With so many of these readings easily accessible online, the success of such collections resides in the editors'/contributor's introductions. Robin, Sörlin, and Warde do a wonderful job of bundling together various conceptual elements under the rubric of 'global change.' Their approach offers a very appealing way to introduce key environmental themes to students in a clear and coherent way."—Edward D. Melillo, Amherst College

"The theme of 'global change' turns out to be an excellent way to structure a collection that includes primary sources spanning three centuries as well as commentaries that are uniformly insightful as well as usefully brief. The long time span makes this collection particularly valuable."—Harriet Ritvo, Massachusetts Institute of Technology

"The editors have done a marvelous job of bringing together a fascinating set of primary materials and a superb set of commentaries that provide something we sorely need: more intellectual history of environmental science and thought."—Jay Turner, Wellesley College

The Future of Nature

Preface

We live in an age of global change and globalization, when "all that is solid melts into air." The twentieth century was a dark century in many ways, but also one of achievement: of unprecedented improvements in longevity, health care, and income. But now, we suspect, the very foundations of our progress put us at risk: the way we are consuming materials is changing the atmosphere. The ecosystems of the planet are under stress. Mass extinctions threaten. The route to health and wealth for much, if not yet enough, of the world's population may turn out to make us poorer and sicker. We look around and find that the Age of Environment is not all about unqualified progress.

The Age of Environment has been nurtured by the Era of Prediction. As present challenges have arisen, we have learned to expect future challenges of a similar kind. Prediction is important to global imagination too, precisely because we cannot "see" the globe, even if the famous and startling "Only One Earth" image of the lonely blue planet from the Apollo missions has provided us with one, now classic, visual frame. Down on the surface or up in the atmosphere, we perceive only an infinitesimal part of what makes "the globe." Different sciences have taken these snapshots and sought to predict futures for them, and to assess what together they might mean for the whole planet. Environmental activists urge us all to think global and act local. But thinking global is not simple or straightforward, and there is much at stake. The sciences that seek to link the atmosphere and oceans, the terrestrial world and the communities that depend on it (including human societies), and the past world and future world, have had to develop assumptions and ways of thinking. This book gathers together some of the documents that have framed these links over the past three centuries. Thinking about environmental change and global futures has led to particular predictions about the dynamics of our planet. The Earth, perceptions of the planetary, and methods of prediction have histories that are intimately linked.

As citizens and voters, researchers, students and policymakers, we are all interested in how the planet works, what's going to happen next, and what we should be doing about it. How should we understand the predictions of the ever growing army of experts that speak for the planet as a whole? Is this just a matter for experts? Can we also do justice to all the ways that people think about

and experience global change? As there is increasing scientific consensus that climate change is real, and that human behaviors are contributing to it, there is an increasing need to understand the political implications of environmental predictions, and their historical context.

In conversations in Copenhagen in 2008, we three editors from different parts of the world developed a sense that the history of "global change" and its associated scholarship could help us reflect on where we think we're going. The history of global change, this extraordinary idea of our time, has not yet been written. It is not easily encapsulated in the history of individual disciplines or in political controversies or social movements. It is a story of the integrative power of certain ideas, techniques and institutions. We wanted to start that. Over the four years since, we have pulled together a wide range of interested researchers at workshops at Norwich, Harvard, Canberra, and Stockholm. Along the way came the idea for an "anthology of documents," each with commentaries. This was a traditional method from literary disciplines, but we apply it here to scientific and other types of writing. Credit goes to our publisher, Jean Thomson Black of Yale University Press, for recognizing that a "source book" was a versatile way to incorporate different voices and documents from a three-hundred-year period into a single volume.

Why an anthology? We want to promote conversations. We don't tell a single story, but rather allow access to the stories that shaped us, and allow readers—students, policymakers, academics, others—to reflect on their own. This is a resource for reflection and re-visioning. But as historians, we have made selections, interpretations, suggestions. We also chose ten big questions of our time to group the documents. So we offer commentaries by a wide range of people with differing professional interests in "global change": historians, climate scientists, geographers, political scientists, economists . . . and they are all responding to these questions using their own methods.

As we complete our task, we look with gratitude and some surprise at the range, caliber, and generosity of the commentators we have assembled, from emerging researchers to figures of world renown, from a range of places and different generations of thinking. A single volume is a small offering in the greater scale of things, but it is a start. We are very grateful to all our contributors, both the original authors of the documents and the commentators on them. Each has brought intellectual excitement and insights that enable us readers to begin to imagine and embrace the enormity of global change and the emerging insight that this change is rapidly becoming a human responsibility, and not just a work of nature.

In this book you will find a little treasure house of ideas, of methods, and visual devices. They include excerpts of both classics and lesser known works;

draw on a range of languages (all translated into English); cover a wide range of fields such as climate science, ecology, history, resilience thinking, demography, economics, forestry, chemistry and future-thinking that sought to integrate across disciplines and sciences. They reflect on lessons learned, unlearned or long forgotten. This is a handbook of how the past saw the future, and how we, their future, might look to ours.

Libby Robin, Sverker Sörlin, and Paul Warde
KTH Environmental Humanities Laboratory, Stockholm
January 2013

How to Use This Book

This is a book you can dip into or read from cover to cover. It is a book of documents that, over three hundred years, have shaped the way we think about our planet and our environment, and the sciences that study global change. Each document is accompanied by a Commentary: a short essay by an expert in the subject that provides context for the document. We have kept outside references in the texts to a minimum, but there is a select bibliography at the back of the book, if you want to read further. Where you find, for example, "(Sörlin and Warde 2009, 16)," you will find the full reference to their book, *Nature's End*, in the bibliography. The relevant point will therefore be found on page 16 of *Nature's End*. Where documents have been adapted or shortened, page numbers from the original are shown in square brackets, with ellipses (. . .) indicating words or sections omitted. When you read a historical document, it is helpful to imagine the audience that it was first intended to reach, as well as to have a sense of its impact today. Each document includes its original date. This is an important clue to the context in which it was written. The commentaries following the documents guide you in your reading. They discuss what the concerns were at the time the document was written, and who was reading the ideas at the time, and since.

The documents are grouped by issues, each with an orienting question. There is an introduction to the book as a whole, "Documenting Global Change," and a short introduction at the beginning of each of the ten parts. References for these are included in the bibliography at the back of the book.

Part Title	Key Question
1. Population	Are we too many, or are we too greedy?
2. Sustainability	Are we limited by resources?
3. Geographies	Are human and natural futures determined or chosen?
4. The "Environment"	How did it emerge?
5. Ecology	How do we understand natural systems?
6. Technology	Does technology create more problems than it solves?
7. Climate	How can we predict change?
8. Diversity	Why do we need it and can we conserve it?
9. Measuring	How do we turn the world into data?
10. The Anthropocene	How can we live in a world where there is no nature without people?

To find a particular document, refer to the contents page. There is also an index at the back of people, places, and topics. Happy reading!

From space, we see a small and fragile ball dominated not by human activity and edifice but by a pattern of clouds, oceans, greenery, and soils. Humanity's inability to fit its doings into that pattern is changing planetary systems fundamentally.

Our Common Future 1987

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Introduction

Documenting Global Change

LIBBY ROBIN, SVERKER SÖRLIN,

AND PAUL WARDE

This book is about change. Almost no one denies that the Earth—along with its continents, oceans, and atmosphere, its plants, animals, and diseases—is changing. These collective changes have become familiar enough to be called by a singular expression: *global change*. The concept of global change is a child of the 1980s, fostered by the emergence of such major international research programs as the World Climate Research Programme (established in 1980) and the International Geosphere Biosphere Programme (established in 1987). From this time on, there has been an interdisciplinary "global change science" conducted by a set of specialists who identify themselves as global change scientists.

There have, of course, been stories about the "whole world" for much longer periods: almost every civilization has creation myths. In the cluster of monotheistic religions that emerged in the region known today as the Middle East, there were global catastrophes like "the Fall" and "the Deluge." But in the new modernist turn to global thinking, the leaders have been almost invariably scientists with an intellectual lineage in the ideas of the Enlightenment. It is rare to find social scientists or scholars of the humanities identifying their subject as "global change." Global change science is mostly large scale, exploring natural systems that encompass the entire Earth or significant portions of it (the oceans, the atmosphere, the polar regions). Their work demands large-scale computer models, which have been greatly enhanced by the information technology revolution that has also gathered pace since the 1980s. The emergence of global change science would have been hard to conceive of in earlier periods when calculations had to be worked by hand and when comparable data were scarcer and traveled much slower. However, it would have been perfectly possible to conceive of a contemporary science without global change science. The idea of "the global" is highly historical—and strongly linked to the second half of the twentieth century.

Another factor in the emergence of this particular science was the idea of "the environment," a concept that emerged in its modern form in the 1940s, to describe the human interface with the planet and nature and all its life-sustaining processes. It might seem now that "the environment" has always been with us, but in fact the idea is a relatively recent creation. It draws attention to the fact that our discovery of "global change" has something to do with what we humans are doing. It is a change in our heads, but also a realization that *we* are driving the change: the idea that humans are unsettling everything, to such a degree that we have come to see everything else as a kind of unity, ranging from the very small (a nearby pond, or an entangled bank) to the oceanic, or atmospheric. Humans have both far-reaching impacts and a responsibility to manage at many scales. Thus the emergence of "global change" and its scientific study is the product of recognizing change as both anthropogenic and global. Since such change is partly driven by people, the new scientific thinking must deal with more than just "forces of nature."

"Global" usually applies to spatial concepts. But *time* is also interwoven in the idea of global change—glaciers melt on a different time scale from political decision-making. One of the millennial initiatives that was created to encourage thinking and planning for the next ten thousand years was the Long Now Foundation, established in 01996 (to use their five-digit dates). The concept was popularized by musician Brian Eno and Stewart Brand, publisher of *The Whole Earth Catalog* (1968–1972). The idea of the "Long Now" is to treat not just what is happening today as "now," but also simultaneously what has happened over seven generations (from grandparents through to grandchildren). As people have recognized that humanity is driving global change, groups like the Long Now Foundation have grappled to translate the dynamics of planetary processes into concepts that humans can comprehend and act on. If humanity is to take responsibility for global change and act as stewards of the planet, we need ways of conceptualizing different rates of change, responses, and lagged impacts, as we are attempting to "think like a planet," to paraphrase Aldo Leopold.

The "Anthropocene" is a term coined by atmospheric chemist Paul Crutzen (see Part 10) to describe the beginning of a new geological era in which the actions of people can be traced in all the biophysical systems of Earth and at many scales—from the microscopic to the whole planet. Crutzen and his co-author, ecologist Eugene F. Stoermer, associated these changes with changes in atmospheric chemistry that coincided with the Industrial Revolution and therefore argued that the Anthropocene dated to the 1780s. While the term "Anthropocene" is still under review by the geological community (which usually determines geological epochs), and its chronology and the implicit causal arguments about