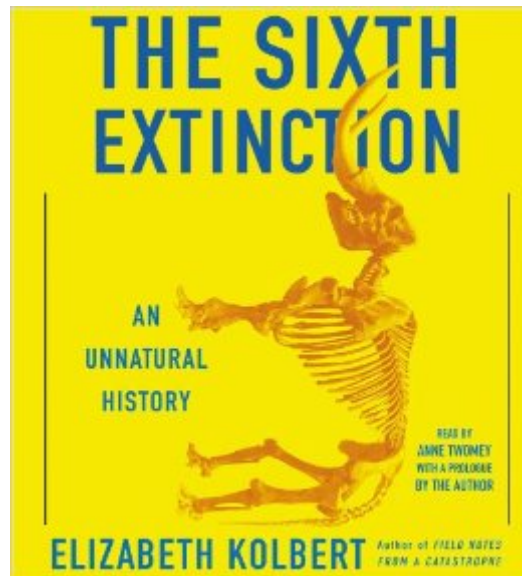


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# The Sixth Extinction



## Synopsis

WINNER OF THE PULITZER PRIZE From the author of *Field Notes from a Catastrophe*, a powerful and important work about the future of the world, blending intellectual and natural history and field reporting into a compelling account of the mass extinction unfolding before our eyes. Over the last half a billion years, there have been five mass extinctions, when the diversity of life on earth suddenly and dramatically contracted. Scientists around the world are currently monitoring the sixth extinction, predicted to be the most devastating extinction event since the asteroid impact that wiped out the dinosaurs. This time around, the cataclysm is us. *The Sixth Extinction* draws on the work of scores of researchers in half a dozen disciplines—geologists who study deep ocean cores, botanists who follow the tree line as it climbs up the Andes, and marine biologists who dive off the Great Barrier Reef. Elizabeth Kolbert, two-time winner of the National Magazine Award and *New Yorker* writer, accompanies many of these researchers into the field, and introduces you to a dozen species—some already gone, others facing extinction—that are being affected by the sixth extinction. Through these stories, Kolbert provides a moving account of the disappearances occurring all around us and traces the evolution of extinction as concept, from its first articulation by Georges Cuvier in revolutionary Paris up through the present day. The sixth extinction is likely to be mankind's most lasting legacy; as Kolbert observes, it compels us to rethink the fundamental question of what it means to be human.

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## Customer Reviews

As a former invertebrate paleobiologist, "The Sixth Extinction: An Unnatural History" is the book I

have been waiting for years to be written. It is a clarion call for ending the current mass extinction that we humans are causing, and a book that should be, according to *Scientific American*, "this era's galvanizing text", worthy of comparison with Rachel Carson's "Silent Spring". It is also a vastly superior popular science book than last year's "Scatter, Adapt, and Remember: How Humans Will Survive a Mass Extinction" written by IO9 science editor Annalee Newitz, simply because Elizabeth Kolbert, a staff writer at *The New Yorker*, has done a superlative job in science reporting, accurately reporting and interpreting work done by some of the most notable researchers of our time studying mass extinctions, whether it is research from Berkeley vertebrate paleobiologist Anthony Barnosky (The lead author of a 2011 *Nature* paper estimating that current extinction rates are equivalent to those of the five great mass extinctions recognized from the fossil record; the terminal Ordovician, terminal Permian, terminal Triassic and the terminal Cretaceous; the latter in which non-avian dinosaurs became extinct.) or American Museum of Natural History curator of invertebrate paleontology Neil Landman, a noted researcher of Cretaceous ammonites, or evolutionary geneticist and anthropologist Svante Paabo, whose team is sequencing the entire Neanderthal genome and recognized the existence of another late Pleistocene hominid species, the Denisovans, from genomic material in a fragment of a finger bone found in a Siberian cave. What Kolbert has written is a spellbinding work of science journalism worthy of comparison with David Quammen's "The Song of the Dodo: Island Biogeography in an Age of Extinctions", and one that belongs on the bookshelves of anyone interested in science, and especially those who may not grasp the full extent of the ongoing mass extinction being caused by us, humanity. Moreover, at the end of her book, she provides an extensive bibliography which notes many of the most important relevant scientific papers as well as important texts written by the likes of notable ecologists James H. Brown and Michael Rosenzweig, and paleobiologists Michael Benton, Douglas Erwin and Richard Fortey. Without question, "The Sixth Extinction: An Unnatural History", may be one of the most discussed, most important, books of popular science published this year. In her opening chapter, "The Sixth Extinction", in prose that is hauntingly beautiful and poignant, Kolbert cites the disappearance of Panamanian frogs and toads as one emblematic of the ongoing crisis in biodiversity, noting that of all the major groups of terrestrial vertebrates, amphibians are the ones which are most rapidly going extinct before our very eyes. She uses the discoveries of fossil mastodons and mammoths in North America and Europe in the 18th and early 19th Centuries in the second chapter ("The Mastodon's Molars") to introduce readers to the great French naturalist Georges Cuvier who was the first to recognize the existence of extinct species and the likelihood that they died during great cataclysms in Earth's history. Her third chapter, "The Original Penguin", is an especially lucid account of British

geologist Charles Lyell's uniformitarian view of Earth's history, and how that inspired Charles Darwin's thinking, not only in geology, but especially, in his conception of the Theory of Evolution via Natural Selection, while describing the rapid extinction of the Great Auk - which was the first bird to be dubbed a "penguin" - in the North Atlantic Ocean along the northernmost coast of North America and Iceland. In the fourth chapter, "The Luck of the Ammonites", she offers an especially lucid account of geologist Walter Alvarez's discovery of the iridium-rich clay at the end of the Cretaceous, leading to the development of the asteroid impact theory for the Cretaceous mass extinction, while also discussing work by such notable invertebrate paleontologists as David Jablonski, David Raup, Jack Sepkoski, and Neil Landman, in noting how the Cretaceous mass extinction that wiped out the non-avian dinosaurs, ammonites and other notable terrestrial and marine organisms, was simply a case of bad luck, which she emphasizes further in describing the probable causes for the terminal Ordovician and terminal Permian mass extinctions (Chapter V). Kolbert devotes two chapters (Chapters VI and VII) to the ongoing "experiment" humanity is performing on the world's oceans, ocean acidification, caused by an excessive increase in carbon dioxide being dumped into them, and noting that it was a likely cause for several of the mass extinctions known from the fossil record. I must commend her for an excellent discussion of the species-area curve known for decades by ecologists, especially through the important research by E. O. Wilson and his colleague Robert MacArthur in the early 1960s (Chapter VIII), as a means of understanding habitat fragmentation (Chapter IX) as a major contributing factor in determining a species' prospects for survival. There are also excellent discussions on how human activity has fostered the unexpected dispersal of animals and plants, creating, in essence a "New Pangea" (Chapter X), that has only accelerated the tempo of the ongoing mass extinction, and the "Pleistocene Overkill" hypothesis (Chapter XI) proposed by geologist Paul S. Martin that has been confirmed, in spectacular fashion, by palynological (fossilized pollen and spores) data from Australia and North America. She describes the extinction of Neanderthals as another, much earlier, example of human-driven extinction (Chapter XII) relying on the notable research by Svante Paabo and his team, noting the importance of the "Out of Africa" theory in explaining Homo sapiens' global dispersal, while also discussing Paabo's "leaky-replacement" hypothesis that accounts for Neanderthals' eventual replacement by Homo sapiens through interbreeding, resulting in hybrids whose descendants include all non-African populations of humanity, contributing between 1 and 4 percent within the genomes of non-African populations, remnants of the Neanderthal genome. In the concluding chapter (Chapter XIII), Kolbert acknowledges she has been amassing evidence demonstrating why the current mass extinction exists, and warning us that "...we are deciding, without quite meaning to, which

evolutionary pathways will remain open and which will forever be closed. No other creature has ever managed this, and it will, unfortunately, be our most enduring legacy."

"The Sixth Extinction" is one of many fundamentally flawed books on climate change; yet I still recommend people read this book. That's because of the dearth of well-done climate change books coupled to the importance of developing public literacy on climate change. You would think that perhaps humanity's greatest contemporaneous threat would result in too many great books to feasibly read. E.g., consider all the great books published around 2009 honoring 150 years since Charles Darwin published "On the Origin of Species". I read seven in that period. Yet with climate change we too often suffer through the amateurish (*Overheated: The Human Cost of Climate Change* by Guzman, Andrew T. [2013]), the overwrought (*Storms of My Grandchildren*; *The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity* (Chinese Edition) ), and here a book that insufficiently covers the very topic referenced in the title - "The Sixth Extinction: An Unnatural History". Here's what Elizabeth Kolbert does well: ' Defines mass extinctions relative to the background extinction rate.' Succinctly explains past mass extinction rates to help us better appreciate individual studies that are now being published regarding current findings.' Provides some good examples of current extinctions that also illustrate why these are harbingers to far worse in the near future.' Good explanation of the lack of diversity at more northern climes and therefore those regions' disproportionate vulnerability.' Excellent reporting on migration rates and varying results, including altitude limitations on migration to chase colder climates.' Kolbert provides a decent explanation on why a warmer world might ultimately result in more biodiversity; but in the short term given current 'cold adaptation' of extant life on earth, mass extinction is inevitable in a 'business as usual' scenario.' Kolbert is an excellent writer and good reporter on the events she reports. Here's where Ms. Kolbert fails: ' Vastly insufficient coverage validating we are currently in a mass extinction event with the exception of her coverage of ocean acidification. I bookmark ScienceDaily articles that report especially impactful scientific climate change findings. I counted fourteen recent peer-reviewed articles preceding publication of this first edition by a couple of years. Not nearly enough of these findings were covered. That where the very title of the book references our already being in a mass extinction event.' Failed to more expansively report and illustrate why a small change in climate can have a devastating impact to whole regions [1]. Such illustrations should help people understand that we can't possibly predict all the catastrophic changes that will come from a fast changing climate; i.e., the "law" of unintended consequences. Such reports would help better align the public's urgency on climate change to the

urgency expressed by scientists and scientific organizations.' Failed to adequately footnote and refer to scientists and studies that she references. For example, on page 166 of the paperback version, Ms. Kolbert refers to a 2004 study on a "species-area" experiment. Both extreme scenarios, the 'best case' and 'worst case', predict catastrophic extinctions by 2050. Not only is this study not end-noted, the author only refers to the year of the experiments; failing to report the authors' names, the articles they published, and where these articles were published [2]. Inadequately providing citations is always a loss of one star with me. I learned a lot reading this book. I enjoyed Ms. Kolbert's writing. I wouldn't remove any material from the book. But ultimately, the mostly anecdotal reports of current extinctions are insufficient for a book that promises to report on the current mass extinction event.1] For example, mountain pine beetles in the Rocky Mountains are killing off millions of acres of lodgepole and ponderosa pines. This is the result of a "minor change" of a 2.7° F warmer region over the past couple of decades. A change that has resulted in an enormous increase in pine beetle procreation rates due to much higher winter survival rates and two reproductive cycles per Spring/Summer/Fall rather than the historical one cycle per year given the shorter winters. The net effect is pine trees dying from up to 60 times higher beetle infestation rates. Mitton and Ferrenberg, "Mountain Pine Beetle Develops an Unprecedented Summer Generation in Response to Climate Warming", *The American Naturalist* Vol. 179, No. 5, May 2012. doi: 10.1086/665007.2] I think Elizabeth Kolbert was referencing Thomas, Chris D. & et al., "Extinction risk from climate change", *Nature* 427, 145-148 (8 January 2004) doi:10.1038/nature02121.

From the title of this book, it would be easy to imagine that it was another science writer creating a book about climate change and attributing our future to that singular event. On the contrary, Elizabeth Kolbert has shown, through a number of examples, how we are destroying our environment and possibly ourselves in the process. Kolbert begins by going through the past five extinctions and explaining what is known of them and how they came about, as well as what organisms were present during each of them that eventually were wiped out. She then travels around the world to look at a number of ways in which we humans are causing the death and destruction of our current environment. That ranges from acidification of the oceans from excessive carbon dioxide levels to clear cutting of forests and to our unwitting transfer of invasive species around the globe on a regular and frequent basis. This book is a wakeup call for all humans. In one way or another, we are all working to end the existence of numerous species and possibly our own. We may possibly be too smart for our own good. A quote from near the end of the book is certainly a message that is cause for us all to ponder! " If you want to think about why humans are so

dangerous to other species, you can picture a poacher in Africa carrying an AK-47 or a logger in the gripping an ax, or, better still, you can picture yourself, holding a book on your lap."Kolbert writes with the non-scientific individual in mind and makes even the most difficult subjects easy to understand. As I said above, we are looking in a mirror and failing to see the destruction we are creating. Kolbert makes us look at that image. This book is fascinating and thought provoking and very much well worth the price!

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