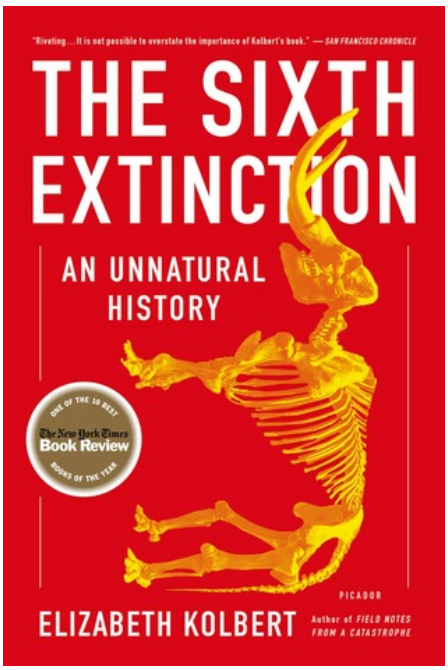


# The Sixth Extinction: An Unnatural History

*Elizabeth Kolbert*

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**The Sixth Extinction: An Unnatural History** Elizabeth Kolbert
2015 Pulitzer Prize Winner

Over the last half-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.

In prose that is at once frank, entertaining, and deeply informed, *New Yorker* writer Elizabeth Kolbert tells us why and how human beings have altered life on the planet in a way no species has before. Interweaving research in half a dozen disciplines, descriptions of the fascinating species that have already been lost, and the history of extinction as a concept, Kolbert provides a moving and comprehensive account of the disappearances occurring before our very eyes. She shows that the sixth extinction is likely to be mankind's most lasting legacy, compelling us to rethink the fundamental question of what it means to be human.

## The Sixth Extinction: An Unnatural History Details

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| ISBN | : | 9781250062185 |
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# From Reader Review The Sixth Extinction: An Unnatural History for online ebook

## Helen 2.0 says

*hides in apocalypse-safe bunker and cries*

A goosebump-inducing nonfiction read! The Sixth Extinction is told in a part textbook, part narrative style; the author gives readers hard facts mixed into detailed personal accounts of her research trips. In 13 chapters, she tells the stories of several species, some long extinct, some still teetering on the brink of extinction, all with one common enemy - us.

The best part of the book is that Kolbert isn't trying to blame the human race or make her readers feel guilty. She only explains the effect we have on our earth and where this could lead (possibly to world domination by giant tool-making rats.) The message is simply, "Here is the information; you decide what to do with it."

Would recommend highly.

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## Melki says

**“When I hear of the destruction of a species I feel just as if all the works of some great writer had perished.” ~ Theodore Roosevelt**

I don't recall ever reading a book that SO made me want to curl up in a ball on the floor and just SOB.

The book ends with a chapter entitled *The Thing With Feathers*, which is hope, according to Emily Dickinson. (Or Woody Allen's nephew, if you know that joke.) Yet this chapter contains some of the more dire information, not to mention the most tear-inducing quotes:

**"We're seeing right now that a mass extinction can be caused by human beings." ~ Walter Alvarez**

**"Right now we are in the midst of the Sixth Extinction, this time caused solely by humanity's transformation of the ecological landscape." ~ plaque displayed at the American Museum of History's Hall of Biodiversity**

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Throughout history, there have been five other mass extinctions that led to **"a profound loss of biodiversity."** But the cause for *this one* lies squarely on our shoulders.

**It is estimated that one-third of all reef-building corals, a third of all fresh-water mollusks, a third of sharks and rays, a quarter of all mammals, a fifth of all reptiles, and a sixth of all birds are headed toward oblivion.**

Let's take a look at some of the things we stand to lose.

**The Panamanian Golden Frog**

**"I sought a career in herpetology because I enjoy working with animals. I did not anticipate that it would come to resemble paleontology." ~ Joseph Mendelson, a herpetologist at Zoo Atlanta**

**The Asian Elephant**

**Coral Reefs**

**. . . if current emissions trends continue, within the next fifty years or so "all coral reefs will cease to grow and start to dissolve."**

**The Sumatran Rhino**

**The Marianas Flying Fox**

This bat has become a victim of the accidental introduction of the brown tree snake.

Disastrously introduced species are discussed in a chapter entitled *The New Pangaea*.
Though Kolbert is no Mary Roach, she does try to inject some humor whenever possible. I got a laugh out of her account of Australia's problem with the cane toad, a critter purposely introduced to control sugarcane beetles. Preschoolers are enlisted to help in reducing the toad's numbers:

**To dispose of the toads humanely, the council instructs children to "cool them in a fridge for 12 hours" and then place them "in a freezer for another 12 hours."**

Be careful when you reach for a popsicle in that house!

So, besides losing lots of wonderful wildlife, why should we care?

**"In pushing other species to extinction, humanity is busy sawing off the limb on which it perches." ~ Stanford ecologist Paul Ehrlich**

Yep, we could be next.

*Rudy Park by Darrin Bell and Theron Heir, July 6, 2015*

There *are* things we can do, but you know how we are when it comes to cutting back and making sacrifices.

Are we willing to do them?

If you want me, I'll be on the floor sobbing.

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## Diane says

This book both awed and depressed me.

From page one, Kolbert writes an impressive survey of how destructive mankind has been to the planet. She gives a brief history of the five mass extinctions that have happened, and travels around the world to report on species that are currently going extinct. But the big problem now isn't a giant asteroid -- it's humans. We are such a lethal force that we can unwittingly (or just greedily) wipe out entire species at alarming rates.

There are a lot of good stories in this book, including the efforts of researchers who are desperately trying to save various species. I don't regularly read science books, but I'm glad I picked up this one. It's a good reminder of how important our environment is to our survival -- we need to do better of taking care of our planet. A lot better, if we want to survive another mass extinction.

Highly recommended for readers wanting a good overview of the subject.

**Opening Passage**
(This intro is so great I had trouble deciding where to end it.)

> Beginnings, it's said, are apt to be shadowy. So it is with this story, which starts with the emergence of a new species maybe two hundred thousand years ago. The species does not yet have a name -- nothing does -- but it has the capacity to name things.
>
> As with any young species, this one's position is precarious. Its numbers are small, and its range restricted to a slice of eastern Africa. Slowly its population grows, but quite possibly then it contracts again -- some would claim nearly fatally -- to just a few thousand pairs.
>
> The members of the species are not particularly swift or strong or fertile. They are, however, singularly resourceful. Gradually they push into regions with different climates, different predators, and different prey. None of the usual constraints of habitat or geography seem to check them. They cross rivers, plateaus, mountain ranges. In coastal regions, they gather shellfish; farther inland, they hunt mammals. Everywhere they settle, they adapt and innovate. On reaching Europe, they encounter creatures very much like themselves, but stockier and probably brawnier, who have been living on the continent far longer. They interbreed with these creatures and then, by one means or another, kill them off.
>
> The end of this affair will turn out to be exemplary. As the species expands its range, it crosses paths with animals twice, ten, and even twenty times its size: huge cats, towering bears, turtles as big as elephants, sloths that stand fifteen feet tall. These species are more powerful and often fiercer. But they are slow to breed and are wiped out.
>
> Although a land animal, our species -- ever inventive -- crosses the sea. It reaches islands inhabited by evolution's outliers: birds that lay foot-long eggs, pig-sized hippos, giant skinks. Accustomed to isolation, these creatures are ill-equipped to deal with the newcomers or their fellow travelers (mostly rats). Many of them, too, succumb.
>
> The process continues, in fits and starts, for thousands of years, until the species, no longer so new, has spread to practically every corner of the globe. At this point, several things happen more or less at once that allow *Homo sapiens*, as it has come to call itself, to reproduce at an unprecedented rate. In a single century the population doubles; then it doubles again, and then again. Vast forests are razed. Humans do this deliberately, in order to feed themselves. Less deliberately, they shift organisms from one continent to another, reassembling the biosphere.
>
> Meanwhile, an even stranger and more radical transformation is under way. Having discovered subterranean reserves of energy, humans begin to change the composition of the atmosphere.

> This, in turn, alters the climate and the chemistry of the oceans. Some plants and animals adjust by moving. They climb mountains and migrate toward the poles. But a great many - at first hundreds, then thousands, and finally perhaps millions -- find themselves marooned. Extinction rates soar, and the texture of life changes.
>
> No creature has ever altered life on the planet in this way before, and yet other, comparable events have occurred. Very, very occasionally in the distant past, the planet has undergone change so wrenching that the diversity of life has plummeted. Five of these ancient events were catastrophic enough that they're put in their own category: the so-called Big Five. In what seems like a fantastic coincidence, but is probably no coincidence at all, the history of these events is recovered just as people come to realize that they are causing another one. When it is still too early to say whether it will reach the proportions of the Big Five, it becomes known as the Sixth Extinction.

(Rereading this intro gave me chills again. Kolbert is such a good writer. She's able to take complex scientific ideas and explain them to a layperson like me. That is an admirable skill.)

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## Bradley says

I've read a lot of non-fiction books that are dry and sometimes gets bogged down in details and others that are very engaging but rather light on the meat. And then sometimes, you get a very cogent work with a very rich sampling of science from all different quarters laid out in such a way that it is impossible to believe anything BUT the final summation.

This is one of those works. We are in the middle of the sixth extinction event on Earth. The final result of the dieoff, as of just how many millions of species will succumb to the tipped balance of the biosphere, is yet to be known.

But let's put it this way: if you were just informed that there were no jobs in your town and that everyone else was just told that 1/3 of the jobs would remain for the next six months, and then after that, they would leave as well, you'd decide to move away. Right? So, you try to, only you find out that someone has just destroyed all the roads in or out of your town and there's no supply line for foods or services. Imagine the chaos. How would you survive? How would anyone? Now assume you slow that process down just enough that no one or very few people living there have a clue as to the reality of this situation. Belts tighten, poverty increases, some may try to move away but get crushed under the wheels of a much larger machine.

Now extrapolate that situation to every other town in the world.

And then overlay the problem to every other species in the world. Dice up ecospheres, destroy the homes and habitats there, and only the fleet of foot can survive... but where do they go? They're an invasive species now. They take on and live or die in someone else's backward. If it's a human's backyard, it'll get killed. Rinse, repeat. Add disease, and predatory species filling in stressed niches, and you've got a pandemic. Across all species.

Now, remember, a few hundred years or even a few thousand is just a flash in the pan for extinctions. Not all come from meteorites or volcanoes. We probably didn't kill off the Neanderthals by hunting. Economics works just as well. And even if a tribe hunts down a wooly mammoth every ten years, the gestation is slow enough that it would still bring a downward pressure on the species until it's gone in several thousand years.

Period. And this isn't even accounting for the widespread death in rainforests now.

Add global warming, acidification of the ocean, the deaths of the coral reefs, the disappearance of the frogs, the bees, and from there, the tipping point that will eradicate larger species as they begin to wipe out other species because their food is disappearing, too, and we've got a major dieback.

In hundreds of years, or even 50, our world might become a bonefield. An optimistic outlook is 25%-50% of everything dead.

THANOS, ANYONE?

Truly a sobering book. One of the very best I've read on extinction events. Only, this one might be ours.

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## Max says

Kolbert makes a compelling case that we are in the throes of a mass extinction citing example after example of our destruction of the environment and its inhabitants. Fortunately she is a gifted writer, so despite the bleak message we don’t just put down this important book in despair. Reporting on scientists investigating threatened species, she identifies the many ways that we are putting all life at risk. Sometimes our unrestrained native instincts are responsible, others the shortsighted and reckless way we use modern industry and technology.

The increase in world population combined with our penchant to explore and settle new territories is one cause. We not only pose a direct threat as super-efficient hunters, habitat disruptors and destroyers; but we bring along a myriad of pests from rats to fleas to fungi to viruses. In the age of jet planes filling the skies and cargo ships filling the sea lanes, just about any organism can end up anywhere. The author describes this as the new Pangaea. Far flung lands might as well be directly connected as we spread invasive species to every corner of the globe. So on top of the many species we have hunted to extinction from the great auk in Iceland to the moa in New Zealand; we have carried in snakes and rats that have eliminated everything from bird populations in Guam to palm trees on Easter Island and more recently spread fungi that have decimated amphibians and bats, to list just a few examples. Within this new Pangaea humanity’s expansion has fragmented wild and natural areas into smaller and smaller enclaves. Species die off as these eco-islands become too small to support the vibrant diversity that existed before.

Compounding the problem is climate change. Kolbert profiles past extinctions in which climate was a factor, but there is a major difference in the current situation – the rate of change. Our climate is changing in decades, not thousands of years giving species little time to adapt. Some species can change latitude or elevation but many are trapped in their remaining “island” habitats, unable to migrate from patches of forest or isolated sanctuaries. Climate change puts ocean life at risk as well. As the burning of fossil fuels loads up our atmosphere with carbon much of it ends up in the sea. Again the speed with which this is happening is the telling factor. The extreme rate of change affords sea creatures little time to adjust to increased ocean acidification and resultant decreased pH and calcium saturation levels. While devastating to calcifiers such as coral this change could favor organisms which pump sulfur into the atmosphere.

Then there is the problem of chain reactions. Flora and fauna are intricately interdependent, as one vulnerable species is eliminated; many others go with it. Kolbert points out that a wide variety of species will perish as the coral reefs die out. Similarly the elimination of rainforests means the highly diversified

ecosystems they support will fail. Every species lost puts another in a precarious position. And of course we too are a part of this chain of life. Kolbert has done a superb job of presenting this crisis in a way that has resonated with many. Hopefully it will help more of us to realize how serious our situation is before it is too late.

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## Emily (Books with Emily Fox) says

This is officially the most boring book I've read this year.

There were some interesting moments but they were too few to compensate.
You'll learn more about random rainforest frogs than you ever wanted...

Also I find that while reading non fiction you have to like the author. One moment during the book she write how she tried to visit a certain location and asked the lady working at the gift shop to give her a tour. The employee obviously told her she was busy and I couldn't help but resent the author for being salty about it.

Don't recommend.

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## Riku Sayuj says

**Dial M for Murder**

This is a dark and deeply depressing book, trying hard to be hopeful — on the lines of Douglas Adams' Last Chance to See.

Kolbert's book reminds us that we could be the last couple of generations to witness true diversity, maybe the last to see such magnificent and delicate creatures as the amphibians.

The story of the Sixth Extinction, at least as Kolbert has chosen to tell it, comes in thirteen chapters. Each tracks a species that’s in some way emblematic — the American mastodon, the great auk, an ammonite that disappeared at the end of the Cretaceous alongside the dinosaurs.

The creatures in the early chapters are already gone, and this part of the book is mostly concerned with the great extinctions of the past and the twisting history of their discovery, starting with the work of the French naturalist Georges Cuvier.

The second part of the book takes place very much in the present—in the increasingly fragmented Amazon rainforest, on a fast-warming slope in the Andes, on the outer reaches of the Great Barrier Reef.

**Martyrs to Awareness?**

Kolbert’s book also spends much ink tracking the history of humanity’s (well, western at least) awareness of extinction and then the science of studying it. It starts from the biblical conception of all creatures as eternal and changeless to the gradual awareness that some animals might be rare or extinct and eventually to the awareness of Natural selection and the importance of change for life on Earth.

Thomas Kuhn, the twentieth century's most influential historian of science, has much to say about such paradigmatic revelations: about how people process disruptive information — Their first impulse is to force it into a familiar framework: hearts, spades, clubs. Signs of mismatch are disregarded for as long as possible—the red spade looks "brown" or "rusty." At the point the anomaly becomes simply too glaring, a crisis ensues—what the psychologists dubbed the "'My God!' reaction."

This pattern was, Kuhn argued in his seminal work, *The Structure of Scientific Revolutions* , so basic that it shaped not only individual perceptions but entire fields of inquiry. Data that did not fit the commonly accepted assumptions of a discipline would either be discounted or explained away for as long as possible. The more contradictions accumulated, the more convoluted the rationalizations became. "In science, as in the playing card experiment, novelty emerges only with difficulty," Kuhn wrote.

But then, finally, someone came along who was willing to call a red spade a red spade. Crisis led to insight, and the old framework gave way to a new one. This is how great scientific discoveries or, to use the term Kuhn made so popular, "paradigm shifts" took place.

*The history of the science of extinction can be told as a series of paradigm shifts. Until the end of the eighteenth century, the very category of extinction didn't exist. The more strange bones were unearthed—mammoths, Megatherium, mosasaurs—the harder naturalists had to squint to fit them into a familiar framework. And squint they did. The giant bones belonged to elephants that had been washed north, or hippos that had wandered west, or whales with malevolent grins. When Cuvier arrived in Paris, he saw that the mastodon's molars could not be fit into the established framework, a "My God" moment that led to him to propose a whole new way of seeing them. Life, Cuvier recognized, had a history. This history was marked by loss and punctuated by events too terrible for human imagining. "Though the world does not change with a change of paradigm, the scientist afterward works in a different world" is how Kuhn put it.*

Are the early participants of Humanity's 'Mega Kill', the 'Sixth Extinction', if you will, martyrs to humanity's self-awareness as immoral killers -- required to make us finally think through to the consequences of our actions?

**Anthropocene & Morality**

Humanity might finally be capable of perceiving the change that has been wrought, and moving into the most crucial understanding of all — that our survival depends on preserving Earth as close to how we inherited it as possible!

The emblematic extinctions are valuable because they serve as blazing sign posts. The eco-system might be too slow in its actions to warn us in time, but our aesthetic sensibility might be capable of warning us in advance when we are too far off the tracks. That might in turn finally engage our moral responsibility for creating an Anthropocene in which most of our co-inheritors of the planet cannot survive. 'Love thy neighbor'? Can we? Or will we continue to shy away from any moral colorings to the argument? Even as we commit to and associate ourselves with blatant Ecocide?

Our biggest threat is ecological, human-induced change and, to be more specific, rate of change:

**When the world changes faster than species can adapt, many fall out. This is the case whether the agent drops from the sky in a fiery streak or drives to work in a Honda.**

## jeremy says

on the dedication page of her landmark 1962 book, *silent spring*, rachel carson quoted humanitarian, biocentrist, and nobel peace prize winner albert schweitzer thus, “man has lost the capacity to foresee and to forestall. he will end by destroying the earth.” in the ensuing half century since carson’s watershed work first saw print, evidence aplenty has proven the prescience of schweitzer’s sentiment with distressing rapidity. in a new book as incisive and imperative as the late ms. carson’s, *new yorker* staff writer elizabeth kolbert confronts what may well be the most compelling, portentous, and defining characteristic of our modernity: the nearly inconceivable and irretrievable loss of earth’s biodiversity at the hands of our own species.

as with her acclaimed 2006 book, *field notes from a catastrophe*, kolbert’s *the sixth extinction: an unnatural history* considers the rapacious effects of humanity’s unmitigated conquest of our planet and its biota – and the harrowing legacy our actions (and inactions) have ultimately wrought. although there have been five mass extinctions over the last half billion years – during which “the planet has undergone change so wrenching that the diversity of life has plummeted” – we now have the distinct and dubious honor of not only “witnessing one of the rarest events in life’s history, [but] also causing it.”

in her preparatory research for *the sixth extinction*, kolbert visited four continents over as many years, witnessing first-hand the evidence of previous extinctions, as well as those that are currently unfolding around the globe. within each of the book’s thirteen chapters, kolbert focuses upon a single species: many facing the imminent threat of extinction and others long relegated to scientific annals.

kolbert’s shrewd reporting, while always engaging, often reveals data that is simply staggering in scope. amphibians, for example, have became the world’s most endangered class of animals, with a group extinction rate as high as 45,000 times the background (or normal) rate. “it is estimated that one-third of all reef-building corals, a third of all fresh-water mollusks, a third of sharks and rays, a quarter of all mammals, a fifth of all reptiles, and a sixth of all birds are headed toward oblivion.” coral reefs, sumatran rhinos, and little brown bats are but a few of the innumerable species currently vulnerable or otherwise imperiled.

it has been suggested that the holocene, a geological epoch that began some 12,000 years ago, has transitioned into what may more aptly be termed the “anthropocene,” on account of humanity’s dominance and the myriad “geologic scale changes people have effected.” amongst the many pernicious man-made forces contributing to our “transformation of the ecological landscape” are fossil fuel combustion, deforestation, ocean acidification, habitat fragmentation and loss, overfishing, the introduction of invasive species, and pollution.

much as she did in her earlier book about climate change, kolbert forgoes an alarmist approach in favor of a measured, well-reasoned style that relies on the facts of her remarkable reporting. with beautiful, luminous prose (well familiar to readers of her *new yorker* articles), kolbert accessibly reveals the extent of the mass extinction we are currently in the midst of. whether recounting the history of extinction as an accepted concept, chronicling the efforts of scientists to assuage its worsening consequences, or regarding mankind’s role in this unprecedented era, she does precisely what she sets out to do: “convey both sides: the excitement of what’s being learned as well as the horror of it.” *the sixth extinction* is assuredly a most significant and substantial work - one that foresees the calamity of our future, and aims to forestall the most ignominious bequest imaginable.

## David says

This book is a very engaging examination of extinctions of animal species through the ages. Elizabeth Kolbert adds a wonderfully personal touch to many of the chapters, as she describes her visits to the habitats where various species are dying out. She accompanies scientists and ecologists as they delve into extinctions, past and present. Some biologists are gathering up endangered species, putting them into special reserves and zoo-like habitats where they might be able to survive.

There is no single cause for the various massive extinctions. Some were due to sudden changes in climate, some due to catastrophes like meteors, some due to disease, and some are due to humans. For example, the mastodon's extinction coincides with the spread of humans. The original penguin--the auk--became extinct due to a combination of factors, including volcanoes and human hunters in the nineteenth century. Coral reefs are dying off because of increasing acidification; much of the excessive carbon dioxide produced by humans is absorbed by the ocean, where the ph level is become less base.

Homo sapiens lived at the same time as other hominid species, such as Neanderthals and *Denisovans*. Visually, Neanderthals were not so different from us. If you gave one a shave and a suit, a Neanderthal might look like this:
So, the question comes up why did these other nearly-human species go extinct, while humans survived? The question is especially appropriate, as there is DNA evidence that humans interbred with some of these other species. The answer is very possibly that humans killed them off.

What makes this book so special, is Kolbert's writing style. She makes me feel like I'm "right there" with the biologists and ecologists. She personally visits the habitats, and goes into some depth talking with the specialists. Each chapter becomes an adventure. Sometimes the subject matter becomes depressing, as it is about the dying (or killing) off of species. But the writing is so engaging, that I highly recommend this book!

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## Barbara says

In this well-researched book, science writer Elizabeth Kolbert casts a strong light on the damage humans are doing to planet Earth. In one example Kolbert describes declining populations of the golden frog, which is rapidly disappearing from all its native habitats. Turns out humans have inadvertently spread a type of fungus that infects the skin of amphibians and kills them. In another example, almost six million North American bats have (so far) died from a skin infection caused by a different fungus, also accidently spread by people.

Perhaps less ecologically-minded people might think "who cares about frogs and bats?" But all species on Earth are part of an interactive ecosystem, and the disappearance of any one organism might set off a domino effect that has unseen consequences down the line. Moreover, these sad occurrences are just the teeny tip of a humongous iceberg when it comes to changes wrought by human activity.

Species extinction is not a recent phenomenon on Earth. In fact there have been five documented instances of mass extinctions (the disappearance of a large number of species in a short time) in the course of the planet's history. These are:

• The Ordovician-Silurian extinction, about 440 million years ago, thought to be caused by cycles of glaciation and melting.

• The Late Devonian extinction, about 360-375 million years ago. The cause is unknown but some experts suggest periods of global cooling and glaciation.

• The Permian-Triassic extinction, about 250 million years ago, which may have resulted from an asteroid impact or massive volcanic eruptions (or both). This was the largest extinction event in Earth's history, wiping out 95 percent of species living at the time.

• The Triassic-Jurassic extinction, about 200-215 million years ago, apparently caused by colossal lava floods - and perhaps global warming - related to the breakup of Pangaea (a supercontinent made of all Earth's landmasses).

• The Cretaceous-Paleogene extinction, about 66 million years ago, thought to be due to an asteroid impact. Evidence for this is the Chicxulub crater in the Yucutan Peninsula of Mexico. This extinction is well known in popular culture because it wiped out the dinosaurs.

Each extinction event left vacant ecological niches
and - over time - these were filled by the expansion of remaining species and the evolution of new organisms. Taking into account all the cycles of extinction and speciation in the planet's history, scientists speculate that 99.9 percent of species that lived on Earth are gone. Unfortunately, humans - by causing profound changes in Earth's ecosystems - may now be causing the sixth mass extinction. Examples of what humans are doing to Earth include:

• Burning fossil fuels, which adds CO2 to the atmosphere. This has a dual effect. It causes global warming, which affects the distribution (and survival) of plants and animals; and it acidifies the oceans, causing calcite to dissolve. Thus, coral reefs are being destroyed and molluscs are getting holes in their shells.

• Destroying habitats to accomodate expanding human populations. This includes cutting down forests, constructing roads and buildings, and cultivating monoculture farms - all of which demolishes the homes of native organisms.

• Transferring organisms to new habitats. When people started moving from place to place they - purposely or not - took other organisms with them. For instance, brown rats - which seem to be indestructible - rode ships to almost every corner of the world, ravaging native species; rabbits brought to Australia as food animals became one of the biggest pests on the continent; brown snakes, introduced to Guam, wiped out nearly all the native birds; and kudzu vines - introduced to the U.S. from Asia - cover and smother all vegetation in their path. It's estimated that people are moving 10,000 species around the world every day, mostly in supertanker ship ballast. The consequences of this are potentially disastrous for indigenous plants and animals everywhere.

• Overharvesting and hunting animals to extinction. In the North Sea, Grand Banks of Newfoundland, and East China Sea, overfishing has severely depleted fish stocks. In addition, many animals have been completely wiped out by humans, including the dodo, Tasmanian tiger, passenger pigeon, Steller's sea cow, and great auk (a flightless bird). In a sad anecdote Kolbert describes how - on July 3, 1844 - a hunter named Sigurður Ísleifsson strangled the world's last two great auks on Eldey Island, near Iceland.

In "The Sixth Extinction" Kolbert sounds the alarm about humans wreaking changes on Earth in the current era - dubbed the "Anthropocene." With luck, Kolbert's book might help persuade concerned people to stop damaging the environment, curtail global warming, and save threatened species. Some measures are already in place: the U.S. has an "Endangered Species Act" designed to protect imperiled organisms; international

agreements have been made to alleviate global warming; and "frozen zoos" store DNA from thousands of plants and animals, in hopes of resurrecting them if they disappear. Still, it may be too little too late.

As far as the Earth is concerned, a "sixth extinction" could be just another cataclysmic event from which the planet will gradually recover. For humans though...well...we might just wipe ourselves out in such a catastrophe. If so, something will inevitably take our place. Elizabeth Kolbert (half jokingly) suggests it might be giant intelligent rats (ha ha ha).

Some people think humans can counteract the harm we've done to the Earth. One "solution" for global warming, for example, involves spraying salt water into low-lying clouds, to enhance their ability to reflect sunlight. Even if this worked, though, it would solve only one problem of many. In the extreme case of irreparable harm to Earth, some optimists(?) believe the human race will survive by colonizing other planets. Only time will tell.

Kolbert's book is well-written, engaging, and personal - with anecdotes based on her own observations as well as interviews with scientists she accompanied on their research trips. I'd recommend this enlightening and interesting book to everyone interested in the Earth's future.

FYI: If you like the 'move to other planets' scenario you might enjoy the novel Seveneves by Neal Stephenson...which has a related theme.

You can read my book reviews at:
http://reviewsbybarbsaffer.blogspot.com/

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## Michael says

A well balanced tour of apparent causes for five past massive extinctions and for the current epoch of the human-caused “Sixth Extinction”. The relatively sudden acceleration of extinctions has a lot of consensus among scientists as defining a new age, the “Anthropocene”.

The author is a journalist who demonstrates a sound knowledge about how science works and its slow and contentious process of reaching consensus conclusions. She travels around the world to visit scientists and sites that are significant in the history of discovery about extinctions, giving focus to specific species that illustrate themes and current issues. For some, putting herself into the picture represents a distraction, but I found the approach an engaging way to put the reader into the picture and humanizing the ecological scientists on the job.

I think all of us are a bit punch drunk over revelations in pieces. One decade we hear of coral dying, and as I recall I could drive on in life thinking that in remote ocean atolls, far from pollution, they will thrive. Another decade you will have heard about disappearing frogs. Sad, but not really bowled over, thinking maybe acid rain, which is getting better; then it was some kind of fungus—then, okay, nothing to feel guilty about and maybe they will come back. In more recent years, the decimation of bats is one more blow, any human cause of the mystery obscure. Years later another weird fungus is identified as a cause. And over the long haul we have grown up with the background threats to survival among top predators like tigers, exotics like rhinos, and all the great apes, a progression obviously tied to human development and deforestation, and illegal hunting. All that leaves me praying sufficient reserves and parks (and zoos) can put their end on pause.

All this bad news sits heavy in a jumble. Why Kolbert is a boon with this is by accommodating lots of

individual cases in the frame of a big picture. And then she gives emerging themes some life through stories from the work of current and historical scientists. The first inferences of extinctions by Cuvier, the geological gradualism of Lyell linked by Darwin to the slow succession of species outcompeting others. Geological epochs on the order of 100 million years get tied to massive changes in the fossil record, which eventually are recognized as mass extinction events and not an ordinary process of natural selection. Major environmental changes of varying types are being applied to the five major mass extinctions. For the last big transition, there was nothing gradual about it. The history of the father and son team, Luis and Walter Alvarez, pursuing against great resistance the asteroid theory for the disappearance the dinosaurs is nicely told by Kolbert.

*An older idea for demise of the dinosaurs*

And now if you begin add up all the extinctions in our current epoch, it begins to approximate the scale of some of these ancient patterns. The background rate of vertebrate extinctions has been estimated as on the order of one per several hundred years, but these days we're talking about thousands of times faster.

Here is a short summary of the major conclusions
*There have been very long uneventful stretches and very occasionally revolution on the surface of the earth. To the extent we can identify the causes of these revolutions, they're highly varies: glaciation in the case of the end-Ordovician extinction, global warming and changes in ocean chemistry at the end of the Permian, an asteroid impact in the final seconds of the Cretaceous. The current extinction has its own novel cause: not an asteroid or a massive volcanic eruption, but "one weedy species."*

She catches me in a relatively ignorant state about the impact of global warming on the acceleration of species extinctions. Like many of us, the threat of global warming on a limited number of arctic mammals dominated my conception of impact (the image of the polar bear on the melting ice is iconic). I missed out on climate change impact in the tropical latitudes. For example, the loss of corals, and all the species that depend on their reefs, is global due to ocean acidification tied directly to the rise of CO2 in the atmosphere (a small rise in pH is enough to hinders the metabolic precipitation of calcium into calcium carbonate). It's happening too fast for the coral to adapt and evolve in step with the changes.

I also never conceived that modest temperature changes could change the balance of competition in the local environment of tropical ecologies and cause extinctions. Tropical areas are hit harder in terms of species loss, partly because that is where the lion's share (so to speak) of species reside. While there are only 5,550 mammals, there are zillions of invertebrates and plants, and they are incredibly specialized in the tropics (and the vast majority remain unidentified). My picture of warm climate species just advancing en masse to higher latitudes as the earth warms does not conform to reality. A long-term research site in the Peruvian Amazon shows how many species just don't make the translocation (especially trees and species that depend on them). And studies at isolated plots of wilderness in Brazil reveal the adverse effects of fragmentation of ecologies,

Part of the big picture that this book helps me with arises from moving the camera back on the time scale for the Anthropocene epoch. If you just consider the industrial age and global warming, you are led to think in terms of the last century or two. But from the time of Darwin, there were already reasoned arguments that man was likely responsible for the global loss of the so-called megafauna, i.e. critters like mastodons, mammoths, cave bears, giant elk, saber-tooth tigers, ground sloths (and a whole weird set in Australia). Thus, it is fair to put the boundary of the new age as far back as the middle of the last ice age. On the same scale, it seems likely that Homo sapiens did away with the Neanderthals (though some hybridizing through interbreeding modifies that picture a bit). A brilliant Swede working in Germany was able from DNA analysis of bones to identify two other humanoids that lost out in the final race to the future (hobbit sized Homo florsiensis and the Denisovans).

Another man-caused impact on species loss is tied to the “Columbian Exchange”, which since 1492 involves worldwide transportation of species. The invasive species cause extinctions when in the new environment they no longer have their usual predators. Kolbert explains how this “New Pangaea” results in loss of biodiversity. Creatures like rats turn out to be the big winners. It’s nice that the New World got earthworms for the first time from Europe, but who knows what they displaced. When a fungus out of the blue takes out frogs worldwide and bats in a fast spreading wave, invasive species linked to human activity rises to the fore in theories of likely cause.

Somehow I will have to digest her grim summary points:
*It is estimated that one-third of all reef-building corals, a third of all fresh water mollusks, a third of all sharks and rays, a quarter of all mammals, a fifth of all reptiles, and a sixth of all birds are headed toward oblivion.*
..
*What matters is that people change the world.*
*This capacity predates modernity, though, of course, modernity is its fulfilled expression. Indeed, this capacity is probably indistinguishable from the qualities that make us human to begin with: our restlessness, our creativity, our ability to cooperate to solve problems and complete complicated tasks.*

If you want to grieve over lost species, I recommend Cokinos’ Hope Is the Thing with Feathers: A Personal Chronicle of Vanished Birds. If you want to travel with a writer to visit and glory in what of endangered species can still be experienced in natural environments, I hope you try Safina’s The View from Lazy Point: A Natural Year in an Unnatural World. If you are ready to face up to the pickle we are in, try learning more of the inconvenient truths through this book.

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## Amanda says

Seemed a good time to float this bad mama-jama (spoiler alert: we're screwed):

Looking for a good horror novel that will keep you up late at night? One that features the most remorseless, inventive, and successful serial killer to ever stumble into the written word? One whose body count grows exponentially as his appetite becomes more ravenous, never sated? One who is so adept at killing that he does so without even seeming to try? Well, I have just the ticket: *The Sixth Extinction* by Elizabeth Kolbert. This is as frightening as it gets, people, and the villain here is us: me, you, and everyone else inhabiting this little blue marble called Earth.

Throughout history, there have been five mass extinction events: the Cretaceous-Paleogene, the Triassic-Jurassic, the Permian-Triassic, the Late Devonian, and the Ordovician-Silurian. All of these involve a cataclysmic shift in environmental conditions, some the result of an external impact. And now Kolbert reports that there may be a sixth extinction: the Anthropocene, caused by the impact of humanity on the environment. Many may believe that this is a byproduct of the Industrial Age, but Kolbert shows us how humans have always had a knack for wreaking wide scale environmental havoc. Always needing and wanting more from our natural resources, we, like kudzu, multiply rapidly, take over every inch of land available to us, and choke out the life that surrounds us.

Kolbert makes the case for recognizing the Anthropocene as a mass extinction event by exploring its casualties and its future victims. As she relates the extinction of the American mastodon, the great auk, and the Neanderthal, as well as the near extinction of the Panamanian golden frog, Hawaiian crow, Sumatran

rhino, and several types of bats, one truth becomes increasingly clear: most of these extinctions began to take place when humans entered the environment.

Despite the disheartening nature of the topic, Kolbert writes with dry wit and gallows humor which (for me) always made an appearance at just the right time before things became too depressing. While there is a lot of science here, Kolbert keeps it accessible for those of us who don't while away our days reading scientific journals (you know, while our basic needs and consumer choices destroy everything around us), and her first person narrative keeps it from veering into textbook territory.

There's a lot here that I enjoyed, but three highlights stand out:

1) Kolbert's early chapters about men like Cuvier, Lyell, and Darwin, who were among the first to speculate on extinction and evolution. From our modern perspective, it's easy to forget that extinction, in particular, is a relatively new idea. There was a time when many scientists believed that nothing could become extinct over the natural progression of time; the discovery of fossils began to shift human understanding of the world and of creation. Reading as these men stumble in their understanding of the world, shifting and revising hypotheses, and ultimately discovering that there was a world that existed before mankind is fascinating.

2) The chapters on the sea and corals (which may eventually become extinct, taking with them several organisms that live symbiotically with corals) is particularly interesting for someone like myself who is happily landlocked. For those who don't live near or have a relationship with our seas and oceans, it's easy to see it as a vast nothingness and forget about the world teeming below our waters. The rate of ocean acidification is frightening.

3) The concept of a new Pangaea is an intriguing one. The ease with which we travel to other states, countries, and continents has, in a sense, reconstituted Pangaea in that we knowingly (and unknowingly) introduce new and often invasive plant and animal species into new environments. In doing so, these new host environments haven't developed nature's evolutionary safeguards to keep the balance between predator and prey, often with disastrous results.

While Kolbert makes all of this lucid and entertaining, as well as terrifying, I must admit to some fatigue when I got to the final chapters. Reading about mass extinction can really take a toll on someone whose worldview can basically be summed up as "people suck." Reading such incontrovertible evidence, and knowing that I myself cannot escape the guilt of this accusation, is, in the words of Kolbert on *The Daily Show*, "kind of a downer." However, we need more downers. We need to be more educated about what we're doing to our environment. Early man deserves a pass: you come into a place and think, "Damn. Look at all these mastodons. We can feast like kings!" So you settle in, live a life filled with mastodon hunts and mastodon meat, have several children, dress them in mastodon onesies, kill more mastodons, always assuming there will be more. After all, you've found the great all-you-can-eat mastodon buffet! You have no concept of the impact your consumption is having on the environment. You haven't seen Disney's *The Lion King* and therefore don't know of the majestic power of the circle of life (nor of the comedic gold of pairing a warthog with a meerkat). Such days of ignorance should be behind us. We know better, so we should do better.

Although, many of us are 4% Neanderthal because apparently early homo sapiens just couldn't resist the seductive power of a ridged brow. So maybe we're not so smart after all.

Cross posted at This Insignificant Cinder

## Jessaka says

"no snow, now ice" by photographer Patty Waymire, National Geographic

Every part of the earth is sacred to my people. Every shining pine needle, every sandy shore, every mist in the dark woods, every meadow, every humming insect. All are holy in the memory and experience of my people.
~~Chief Seattle

When I was a child my favorite books were the Golden Nature Guides about insects, birds, sea shells, and so on. I learned many insect names, as well as those of the butterflies and other animals. I also remember seeing so many different varieties of wildlife back then. Little did I know then that in later years I would look for the birds, butterflies and insects of my youth and not see many of them. I jump for joy when I see a praying mantis, an inch worm, or a walking stick. We are losing our bees, and I seldom see those either. If we lose them all we lose our fruits and other plants that need pollinated. China has to hand pollinate now. The only butterfly I see here are black swallowtails. What happened to the buckeye, the yellow swallowtail, and all the others?

This year I learned that black swallowtails love fennel, so I was given some fennel to plant in hope that it would draw more of them to my garden. One day I saw two caterpillars on it, and they had eaten all the fennel, As I was watching them, they crawled off to look for more food. Not finding any, they crawled back onto the fennel. I called a friend who asked me to bring the caterpillars over to her house. She put them in a jar with fennel where she could keep them safe from the birds. They made cocoons, hatched and flew off. Why do we even have to do this? What happened?

Little did I know back in my youth that we would be losing wild life. There is so much we didn’t know back then, but then I remember my 8th grade teacher, Mr. Bailey, telling us about the book "Silent Spring" by Rachel Carson, about a time when we would not be hearing song birds and other sounds of nature. No one listened then; they still don't listen. When it is silent they will listen and not hear a thing.

Like "Silent Spring" this book was written as another warning. It won the Pulitzer Prize. It is easy to understand and at times it is enjoyable, that is, if you like reading about nature.

Did you know that there is a flower that ants live inside of, and that the flower allows them to live there because the ants kill other insects that may try to harm it? Did you know that there are such things as antbutterflies that swarm around army ants, and that they live off the droppings of the antbirds that also swarm around the flower?

I loved reading that kind of information, but we are that sixth extinction that she writes about. It is sad to see what we are doing to this planet and to learn that many species are dying daily. My brother said, "We don't deserve this planet." How true.

The author said some things that made me feel a little better but not by much. She mentioned that during the last extinctions new life forms evolved. New life forms sounds encouraging, but who wants to lose what we have now?

I often think of how much we have Junked out this earth. I wonder if it will die, or if something will happen that will save it. When I read this next paragraph I thought of how nice it would be to have all of our Junk reduced to the size of a cigarette. The author mentioned a scientist, one Professor Jan Zalasiewicz, who "is convinced that even a moderately competent stratigrapher will, at the distance of a hundred million years or

so, be able to tell that something extraordinary happened at the moment in time that counts for us as today. This is the case even though a hundred million years from now, all that we consider to be the great works of man—the sculptures and the libraries, the monuments and the museums, the cities and the factories—will be compressed into a layer of sediment not much thicker than a cigarette paper."

Other quotes: "Though it might be nice to imagine there once was a time when man lived in harmony with nature, it's not clear that he ever really did."

"Under business as usual, by mid-century things are looking rather grim," he told me a few hours after I had arrived at One Tree. We were sitting at a beat-up picnic table, looking out over the heartbreaking blue of the Coral Sea. The island's large and boisterous population of terns was screaming in the background. Atmospheric scientist Ken Caldeira paused: "I mean, they're looking grim already."

"Having freed ourselves from the constraints of evolution, humans nevertheless remain dependent on the earth's biological and geochemical systems. By disrupting these systems—cutting down tropical rainforests, altering the composition of the atmosphere, acidifying the oceans—we're putting our own survival in danger."

"Ninety percent of all species on earth had been eliminated."

"According to the UN Environment Programme, the Earth is in the midst of a mass extinction of life. Scientists estimate that 150-200 species of plant, insect, bird and mammal become extinct every 24 hours. This is nearly 1,000 times the "natural" or "background" rate and, say many biologists, is greater than anything the world has experienced since the vanishing of the dinosaurs nearly 65m years ago. Around 15% of mammal species and 11% of bird species are classified as threatened with extinction." ~~John Vidal, environment editor

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## Trish says

Kolbert's premise, that we are likely in the midst of the Sixth Period of a great extinction in the world's history, is "a most awful yet interesting" idea, to quote Darwin out of context. Kolbert shares recent (in the past forty years) scientific discoveries, theories, and test results which many of us may not have had a chance to follow with the diligence of a scientist. She is not a scientist but a journalist who has interviewed scientists, and her wonderful easy style makes it simple for us to understand.

What Kolbert has done here is to overlay a timeline transparency of extinctions over the history of the earth's geologic record and mankind's progress with which we are more commonly familiar. Kolbert is merely reporting in this book, not advocating, though the reader comes away with an awakened sense of attention and sense of the irony that man himself may be the instrument of his own destruction.

Kolbert is what could be called a "neocatastrophist." She believes that the scientific record shows that conditions on earth change only very slowly, except when they don't---"long periods of boredom interrupted by occasionally by panic. Though rare, these moments of panic are disproportionately important." Her reportage brings her to the conclusion that we are in the midst of a great extinction and that in the future…far into the future, the geologic record will clearly show something extraordinary happened in the hundreds of thousands of years of human habitation. But it may be visible only to giant rats, the one species she concludes may be likely to survive and thrive.

While at first Kolbert shares current examples of species extinction happening right now, gradually she

comes to zero in on probable cause: habitat modification caused by humans. She takes us through a riveting series of investigations scientists around the world are conducting to test how species adapt to changes in environment like carbon dioxide levels, for instance. Since continents are so well-travelled now, there are fewer areas uncontaminated by introduced species which may or may not be invasive or destructive to native species. Kolbert argues that man's unparalleled and insatiable need to discover, innovate, and change his environment was like "bringing a gun to a knife fight."

> "To argue that the current extinction event could be averted if people just cared more and were willing to make more sacrifices is not wrong, exactly; still, it misses the point. It doesn't much matter whether people care or don't care. What matters is that people change the world."

That is not to say that we couldn't slow the event down a little, at least for humans, if we began to pay attention at this point. "As soon as humans started using signs and symbols to represent the natural world, they pushed beyond the limits of that world." We are just witnessing the outcomes now.

Kolbert writes "Though it may be nice to imagine there once was a time when man lived in harmony with nature, it's not clear that he ever really did." Perhaps American Indians with their roaming, nomadic habits, no fixed abode, and principles including commune with nature and not taking more than they needed to survive, may have been the last great environmentalists. They had a light footprint, didn't they? Or am I completely wrong about that?

In the last couple of paragraphs, Kolbert points out that some scientists are seriously considering reengineering the atmosphere by scattering sulfates in the stratosphere to reflect sunlight back to space, or alternatively, to decamp to other planets. That, so far, is their best work. Perhaps if we just cut back on consumption, and left fossil fuels *in the ground*, we'd live long enough to figure out a better option.

Kolbert's thesis ought to spark discussion, if nothing else. But we may also be witnessing the real-time devolution of our own species…no talk, no compromise. Get my gun.

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*„Homo Sapiens ???? ?? ???? ?? ???? ?????????? ?? ??????? ????????, ?? ??????? ?? ????? ? ???? ?? ???????? ??.“*

? ??????????: Keep up the good work.
*Ike Interviews God*