

## **Has the world entered a sixth, great extinction era? If not, could capitalism soon take us there?**

By Roger Annis, [first published in \*A Socialist In Canada\*, January 24, 2018](#)

Peter Brannen's 2017 book *The Ends Of The World* is surely one of the most important books of the year. The author surveys the five great extinctions of species which have marked Earth's history and examines whether the Earth is on the verge of a sixth mass extinction.[1]

It's a difficult hypothesis to ponder, considering what is at stake, the emergency response that is required if we determine that the threat is real, and the fact that anthropogenic disruptions could be entirely to blame. The fact that such a potential scenario occupies scientific attention lends a great urgency to examining it.

The prevailing philosophical methodology of capitalism is a static one. It downplays or ignores the dialectical interplay of biological, geological and human social forces at work on the planet. This, in turn, encourages the false idea that a world of catastrophic decline and disappearance of many if not most biological species need not spell the end of the dominant species, humans. That is folly. Humankind's fate has always been tightly bound to that of the other species with which we share the Earth. The dialectical interplay and dependence among us all cannot be broken or dismissed.

*The Ends Of The World* does not shy away from making troubling warnings that humankind's fate may rest in how seriously we examine the looming threat of a sixth, great extinction and what we, the human race, intend do about it.

### **Extinctions**

The first of the Big Five extinctions occurred 445 million years ago. The last one was 66 million years ago—the one that killed off the dinosaurs. Here are the five mass extinctions that have taken place during Earth's history:

- **End-Ordovician, 445 million years ago** A severe ice age led to sea level falling by 100 meters, wiping out 60-70% of all species which were prominently ocean dwellers at the time. Soon after, the ice melted leaving the oceans starved of oxygen.
- **Late Devonian, c 360 million years ago** A messy, prolonged climate change event, hitting life in shallow seas very hard, killing 70 per cent of species including almost all corals.
- **End-Permian (Permian-Triassic), c 250 million years ago** Some 90 per cent of species perished, strongly linked to massive volcanic eruptions in Siberia that caused a savage episode of global warming. ([Essay by Peter Brannen on the End-Permian, July 2017.](#))
- **Triassic-Jurassic, 201 million years ago** Three-quarters of species were lost, again most likely due to another huge outburst of volcanism.

- **End-Cretaceous (Cretaceous-Tertiary), 65 million years ago** A giant asteroid struck today's Mexico, likely causing volcanic eruptions in other parts of the globe.[2]

[This chart of the geologic time scale](#) further displays Earth's history.

What caused the five mass extinctions? *The Ends Of The World* lists four large culprits:

- Continent-scale volcanism, caused by the movements of the Earth's surface plates.
- Dramatic changes to the climate and the oceans driven by the forces of geology, including periodic, massive volcanic eruptions as mentioned above.
- Changes to the planet's environment caused by the actions of biological species as they evolved. "In the geological past, seemingly small innovations have reorganized the planet's chemistry, hurling it into drastic phase changes."
- In the case of one extinction--the End-Cretaceous--a massive asteroid impact.

Is the rate of species extinction today anywhere near comparable to the past five events? If not, could anthropogenic damage to the thin, surface wrapping of Earth's biosphere nevertheless bring us to a sixth extinction event?

Brannen answers no, and yes. He surveys the scientific literature on the subject and talks to a great many paleontologists and other scientists. Listed in the appendix below are one article and three scientific papers presenting contrasting views of whether a sixth extinction is underway. Brannen concurs with those scientists who argue that while the 'background' rate of species extinction has indeed accelerated since the advent of human industrial society a few centuries ago, the extinction rate is not *yet* comparable to those of the Big Five. But Brannen's overall conclusion is nonetheless extremely dire. He writes:

... The terrifying reality of ocean acidification has only fully dawned on the scientific community in the last decade or so. Even more so than global warming, ocean acidification is what people who understand the fossil record, and who think about the future of the oceans, are most distressed by.

... Considering how much we've already done to dismantle coral reefs, and projecting these trends forward into anything resembling geological time, it becomes clear why it's not unreasonable to compare what is going on today with the worst disasters in Earth's history.

... Undoubtedly, there are some obvious, unsettling parallels between the Triassic end-times [Triassic extinction, 201 million years ago] and the current day—when, barring aggressive climate action, temperatures on the planet are expected to jump as much as six degrees, if not by the end of this century then sometime during the next, with the oceans acidifying not on the scale of thousands of years but within decades.[3]

In a concluding chapter of his book, Brannen examines the current political climate in which most capitalist governments pledged at the world climate summit meeting in Paris in 2015 to limit global warming to 1.5 to two degrees Celsius by the year 2100. He observes:

... Many of us share some dim apprehension that the world is flying out of control, that the center cannot hold. Raging wildfires, once-in-1,000-year storms and lethal heat waves have become fixtures of the evening news—all this after the planet has warmed by less than one degree [Celsius) above pre-industrial temperatures. But here's where it gets really scary.

If humanity burns through all its fossil fuel reserve, there is the potential to warm the planet by as much as 18 degrees Celsius and raise sea levels by hundreds of feet. This is a warming spike of an even greater magnitude than that so far measured for the End-Permian mass extinction.

... The last time it was four degrees warmer, there was no ice at the poles and sea level was 260 feet higher than today.

### **The Sixth Extinction, by Elizabeth Kolbert**

The discussion of a sixth extinction came into the literary mainstream in 2014 following the publication of *The Sixth Extinction: An Unnatural History*, by Elizabeth Kolbert.[4] The author won the 2015 Pulitzer Prize for general, non-fiction writing. Her book details the past as well as present disappearances (or threats of same) of 13 iconic species and presents the opinions of many scientists who are studying extinctions. The scientists offer explanations as to why past extinctions happened and are happening today, and what this may signal for the fate of humankind. Kolbert writes:

... "It's pretty clear that times of high carbon dioxide—especially times when carbon dioxide levels rapidly rose—coincided with the mass extinctions," writes University of Washington paleontologist and End-Permian mass extinction expert Peter Ward.

"Here is the driver of extinction"...

Kolbert discusses the troubling phenomenon of the *lightning pace* of present-day, anthropogenic change. Whereas in the past, changes in the chemical composition of the atmosphere and oceans causing disruptive climate change took place over tens and hundreds of thousands of years, today's changes are being induced by human activity in time scales of tens or hundreds of years--a few thousands of years at the outermost. In geological time, this is nothing. She writes:

Roughly one third of the CO<sub>2</sub> that humans have so far pumped into the air has been absorbed by the oceans. This comes to a stunning 150 billion tons. As with most aspects of the Anthropogenic, though, it's not only the scale of the transfer but also the speed that's significant... It makes a big deal to marine chemistry whether carbon dioxide is added over the course of a million years or a hundred [years]...

If we were adding CO<sub>2</sub> to the air more slowly, geophysical processes, like the weathering of rock, would come into play to counteract acidification. As it is, things are moving too fast for such slow-acting forces to keep up. As Rachel Carson once observed, referring to a very

different but at the same time profoundly similar problem, "Time is the essential ingredient, but in the modern world there is no time."

Brannen addresses this same danger:

Warm times aren't necessarily a bad thing... But when climate change or ocean chemistry changes have been sudden, the result has been devastating for life...

And further:

"We're not just warming, we're not just pollution, we're not just over-exploitation: we're piling it all on simultaneously," paleontologist David Jablonski of the University of Chicago told Brannen p 263. "That's why it's really inaccurate to argue that because there's been warming in the past that doesn't count now--because it's part of the perfect storm. I think that all mass extinctions work that way... lots of things go wrong."

Can species adapt to rapidly rising temperatures? The evidence suggests not. Kolbert writes:

It's quite possible that by the end of this century, CO2 levels could reach a level not seen since the Antarctic palms of the Eocene some 50 million years ago. Whether species still possess the features that allowed their ancestors to thrive in that ancient, warmer world is, at this point, impossible to say.

### **A needed but overlooked or ignored discussion**

Considering how dire are the potential consequences of a new, sixth extinction for human civilization (nothing less than its self-destruction!), it is surprising how little the subject has entered into the political and environmental mainstream. Three large reasons for this seem to stand out.

The big one lies in the vested interests and insatiable expansion dynamic of the capitalist economic order. For more than a century, following the emergence of a science of anthropogenic climate change [5], science has known of the damaging ecological consequences of human industrial and agricultural pursuits. But capitalist greed as well as the politics which accompany the ruthless dynamic of the capitalist order have blocked official recognition of the dangers.

Only in the past two decades have capitalist governments been forced to accept the science of anthropogenic global warming. Yet even here, the recognition is only in word, not in deed. Incredibly, in the year 2017, the world's largest government has reverted to outright denial of anthropogenic global warming.

The dominant, capitalist classes of the world are unmoved and uncaring of all the destruction their economic system is causing. Mainstream politics has merely moved from *denial* of global warming to *deflect and delay*. Nary a single, large capitalist government in the world strays from the *practice* of deflect and delay.

The second big reason for inaction is the poor state of scientific education in the world's populations. Education systems under capitalism deliberately downplay the 'awkward' subject of Earth's history and humankind's heretofore very small place within that. Humans are taught to think first and foremost of self-interest. Our learned time scales are limited to the duration of home mortgages, the time until retirement age is reached, or the lifespans of grandchildren. Of course, many of us do our best to expand such limited time frames through formal education and life experience, especially what we may learn through the course of political advocacy. But the relative weakness of popular, scientific awareness inclines people to political passivity and pessimism. Societal and scientific challenges are considered 'too big, too complicated' for ordinary mortals to tackle.

Finally, a vibrant and cutting-edge political left could make essential contributions to the necessary fight for scientific literacy and consequent social and economic action. But the global left has been in decline for decades [6] and this decline has not been reversed by the global warming emergency coming to widespread public attention beginning some 25 years ago. The global left (Marxist, anarchist, liberal) should be making significant theoretical and practical contributions to the science of political economy in light of the global warming emergency. It is doing so only partially, and entirely inadequately. [7]

### **Business as usual in the environmental movement**

The mainstream, liberal environmental movement has its own variant of 'deflect and delay'. It is resigned to the 1.5 degree temperature rise of the 2015 United Nations climate agreement in Paris (ratified by a [follow-up UN conference](#) in Bonn, Germany one year later). It looks away uncomfortably from the fact that the 1.5-to-2 degree rise to which the UN is resigned will already bring catastrophic disruption to human society while 'feedback loops' risk average global temperature rises that will blow past two degrees.

Oh sure, there is recognition by liberal environmentalists of the dire predicament into which the prevailing conditions of industrial and agricultural production are dragging humanity. But where is the recognition that the world has *already entered* an *emergency state of affairs* requiring a series of *emergency measures*, beginning with a rapid winding down of all the plunder and excess characteristic of capitalism? Where is the recognition that the *relentless expansion drive of capitalism* is continuing to fuel limitless natural resource plunder and production of commodities for sale and consumption?

Such questions are not yet at the center of attention of the environmental movement, leave alone broader society. Instead, we hear positive scenarios that switching from fossil fuels to [alternative energies](#), making lifestyle changes such as driving electric automobiles or taking public transport, and stopping this or that fossil fuel project through divestment or direct action will place the world on a safer track. Yes, struggles for short-term relief are important insofar as they educate people and provide relief from the grotesque excesses of capitalism. But they won't stop the capitalist juggernaut unless they are connected to strategies for much deeper change.

Peter Brannen calls the 2015 conference in Paris a "catastrophic failure". He writes:

There are no binding commitments, and countries' adherence to the agreement is voluntary. Though the signatory countries announced their intent to aim for 1.5 degrees of warming, the agreement itself sheepishly acknowledges that if every country met their optimistic emissions pledges, the planet would still easily sail past two degrees.

Brannen cites University of Chicago geophysicist David Archer: "I have a feeling that by the time we get close to two degrees Celsius, we'll think it's pretty insane we ever thought that was a target to shoot for."

Brannen goes on to cite Columbia University economist Scott Barrett's view of the Paris agreement: "The only way the voluntary contributions pledged so far could achieve the collective two-degree goal is if a miracle occurs around 2030, some technological breakthrough forcing global emissions to plummet. Even then, the chances of staying within the two-degree goal are no better than 50-50."

The rest of Brennan's survey of a post two-degree warmer world is, well, rather grim. There is no switch to flick whereby warming stops at two degrees. No, warming (rising greenhouse gas emissions) begets more warming. Even if emissions are cut radically, feedback loops risk taking on a life of their own.

One of the insights gained from a 433 million-year perspective on Earth's past and future is that of the relative insignificance of the time scale in which humans have inhabited the planet. Homo sapiens have only been around for some 160,000 years. Even our hominid ancestors from whom modern humans evolved take us back a 'mere' six million years. That's not so old compared to the 600 million or so years since the first multi-celled creatures evolved or the 65 million years since the fifth and last of the great extinctions. There is no fatalism or resignation in Brennan's book. After all, were we truly to find ourselves in a sixth extinction, there would be nothing left to do but prolong as long as possible our inevitable disappearance. No, his book is a call to action, even if prescriptions of what to do are left unanswered.

### **Emergency situation cries out for emergency responses**

If the world is in such a dire state as to place the danger of a sixth extinction on the agenda of scientific debate, where is the political recognition of the emergency? Where are the proposals for emergency responses that are called for?

John Bellamy Foster sketches elements of the radical political program which the planetary situation demands in an article in the [November 2017 Monthly Review](#). He writes:

... But to [provide all people with the ability to develop their full potential], we will need to break with "business as usual," that is, with the current logic of capital, and introduce an entirely different logic, aimed at the creation of a fundamentally different social metabolic system of reproduction. To overcome centuries of alienation of nature and human labor, including the treatment of the global environment and most people—divided by class, gender, race, and ethnicity—as mere objects of conquest, expropriation, and exploitation, will require nothing less than a long ecological revolution

In a [late-December 2017 interview](#) with the Venezuelan state-funded *TeleSur* news network, he returns to a similar theme:

... Confronted with the effects of climate change, ecological socialism – with its emphasis on communal relations and adaptation to the environment – is far superior to neoliberalism's empty insistence on "resilience."

However true and important these assertions, they rest in the realm of generalities, revealing a certain 'spinning of wheels' by leading ecosocialist (Marxian) thinkers. We find little by way of 'what to do' in the here and now. What are the immediate and longer-term changes in *societal organization* and *production and consumption patterns* required of human society in the face of the global warming emergency? What is the role of *governments* in the great societal transformations that are needed? What are the *social and political alliances* within and between classes that are possible and necessary in order to win governments that can place human society on a path toward *ecological and societal salvation*?

This is my third recent article on the politics of the global warming emergency. The [second of these articles](#) was published nearly one month ago, drawing attention to the writings of Jason Hickel, an advocate of 'degrowth'. He defines degrowth as a "shift to a different kind of economy altogether – one that supports and promotes the commons, and focuses on improving human well-being rather than only on improving monetary incomes."

My article [one month before that](#) commented on the call by *Guardian* writer and ideologue George Monbiot that 'everything must go'. I wrote:

'Everything must go' is the headline of the latest column by the liberal *Guardian* columnist George Monbiot. It's a stark statement that should henceforth be the theme of all serious discussion of the global warming emergency. All the waste, excess and plunder of the capitalist economic order 'must go'. To be replaced by a planned, social economy in which humans live in harmony with the planet's finite resources and the species with which we co-habit.

I have been writing along these lines for several years now. I have argued that it is imperative for human society to carry out a radical contraction of all the 'productivist' plunder, excess and waste which characterizes capitalist society. While I share the general, socialist outlook of the 'ecosocialist' movement—that is, the imperative of creating a planned economy which prioritizes human development and seeks harmony with our natural surroundings—I hold to the Marxist view that the exploited classes and peoples of capitalist society (workers, peasants and farmers, First Nations people, the marginalized and unemployed) are the motor force of social change. Their ascendance to a leading role in society issues naturally from their relative lack of material stake in society as it exists and the commonality of interest created by the class struggle against the wealthy property owners. This is especially the case with the billions of people residing in the Global South who, to paraphrase Karl Marx, have 'nothing to lose but their chains'.

To achieve lasting change—and here we arrive at the core of Marxist political thought—the exploited classes must fight for an independent role in the political realm. They need political

parties and social organizations to represent their distinct class interests, the goal being to win political power and use that lever to lead social transformation (salvation). Working class governments must aim to win the widest possible support from all classes and social groups in society. This old idea (for Marxism) takes on a new urgency. The scale of the global warming emergency obliges humans to engage politically and achieve the broadest social and political coalitions that history has ever known.

### **Sketching a path forward**

In past articles, I have sketched out some of the large objectives which human society must set for itself in the short term in order to mitigate the worst of what is already descending upon us. Let me restate those and add a few new ones:

\* Human society is in the grip of a social and ecological *emergency* due to global warming. The *salvation* of human society is at stake. A new, alternative path of human development is needed which aims for social equity and harmony with the natural world--in other words, an entirely new moral plane. Radical thinkers must fight to win such recognition in broad society and win corresponding political and social measures in response.

\* Emergency responses must begin with allocating vast resources from the wealthy classes and countries of the world to assist those who are being hit the hardest by the onset of climate change--the billions of poor people in the countries of the Global South.

\* A winding down is needed from the frenetic and endless production of commodities for sale irrespective of their contribution to human development. In its place, economic production will be geared to meeting social needs. Massive reduction in all the plunder, waste and excess of capitalist, consumerist society is needed.

\* A new, ecological economy will aim to limit its consumption of natural resources and its production of material goods. It will prioritize the essential elements of human survival and development: shelter, education, culture, health care, applied science and food and energy production.

\* Among the shifts this will require are total changes in how cities are planned. The automobile must be curtailed to all but essential transport. Food production must be localized to the maximum extent possible. The production of energy, too, must be localized (and greatly reduced from today's gluttonous levels).

\* A planned and socially-agreed reduction of human population levels is needed. Along with this will be a pullback by humans from vast areas of the planet in order to provide living space for the other species with which we share the planet and which face extinction if we do not act.

\* Needless to say, armaments and warfare must be eliminated.

\* Social inequity will be reduced equalized so there will no longer be rich and poor people and all will be given opportunity for personal and social development.

All of this requires the full participation and leadership of the working class, in all of its diversity--workers in the factories, offices and technology industries; farmers and peasants; Indigenous peoples; youth, women and the racially oppressed. This presupposes a vast expansion of workplace and societal democracy.

**Notes:**

[1] *The Ends Of The World: Volcanic Apocalypses, Lethal Oceans And Our Quest To Understand Earth's Past Mass Extinctions*, published by HarperCollins, 322 pp, ISBN 9780062364807. Here are two reviews of the book:

- by David Wineberg, published in the *San Francisco Review of Books*, June 3, 2017 <http://www.sanfranciscoreviewofbooks.com/2017/06/book-review-ends-of-world-volcanic.html>
- by Emmet Martin Penney, published in *Paste Magazine*, June 14, 2017 <https://www.pastemagazine.com/articles/2017/06/peter-brannen-ends-of-the-world.html>

[2] A growing school of scientific opinion argues that the impact of that asteroid strike (forming the huge Chicxulub crater in Mexico) could not have sparked the End-Cretaceous extinction by itself, that it also triggered enormous volcanic eruptions in other parts of the globe, most notably at the Deccan Traps geological formation in today's northern India.

[3] Climate change writer Dahr Jamail provides the latest news of the loading of carbon into the world's oceans and their consequent temperature rises in his latest, monthly column in *Truthout.org*: **2017 was the warmest year on record for oceans**, [by Dahr Jamail, Truthout.org, Jan 18, 2018](#).

[4] Here are two reviews of Elizabeth Kolbert's *The Sixth Extinction*:

- **How to Destroy Species, Including Us**, [by Verlyn Klinkenborg, New York Review of Books, issue of March 20, 2014](#)
- **What killed the Neanderthals?**, [by Luke Mitchell, London Review of Books, issue of May 8, 2014](#)

[5] See John Bellamy Foster's June 2015 essay, '[Late Soviet Ecology and the Planetary Crisis](#)'. Foster and his fellow Marxist writers Paul Burkett and Kohei Saito have pioneered the renewal of the concept of the *metabolic rift* pioneered by Karl Marx. See Foster's December 2013 essay, '[Marx and the Rift in the Universal Metabolism of Nature](#)'.

[6] See this essay by Roger Annis: **Reflections on the Russian Revolution of 1917**, September 2017

[7] See these two essays by Roger Annis:

- **'Everything must go'** writes environmental writer George Monbiot, [Nov 27, 2017](#)
- **Jason Hickel: 'Degrowth promotes the commons and focuses on improving human well-being'**, [Dec 27, 2017](#)

*Roger Annis publishes his writings on his website 'A Socialist In Canada', along with selections of writings by others. His extensive writings on the global warming emergency can be found in the 'Environment' category on the website; the most noteworthy of those are listed in the 'Featured articles' page on the home page. See also the 'Ecology newsroll' on the home page, which commenced January 2018. He can be reached at [rogerannis@hotmail.com](mailto:rogerannis@hotmail.com).*

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## **Appendix:**

*Here is a selection of contrasting views of whether a sixth extinction is underway:*

No:

**Earth is not in the midst of a sixth mass extinction**, [by Peter Brannen, \*The Atlantic\*, June 13, 2017](#)

... [Smithsonian paleontologist Doug] Erwin's other point, that the magnitude of the Big Five mass extinctions in Earth's past dwarfs humanity's destruction thus far, is a subtle one. He's not trying to downplay the tremendous destruction wrought by humans, but reminding us that claims about mass extinctions are inevitably claims about paleontology and the fossil record...

Yes: (three scientific papers)

1. **Thresholds of catastrophe in the Earth system**, by Daniel H. Rothman, [published in \*Science Advances\*, Sept 20, 2017](#)

Abstract:

The history of the Earth system is a story of change. Some changes are gradual and benign, but others, especially those associated with catastrophic mass extinction, are relatively abrupt and destructive. What sets one group apart from the other? Here, I hypothesize that perturbations of Earth's carbon cycle lead to mass extinction if they exceed either a critical rate at long time scales or a critical size at short time scales. By analyzing 31 carbon isotopic events during the past 542 million years, I identify the critical rate with a limit imposed by mass conservation. Identification of the crossover time scale separating fast from slow events then yields the critical size. The modern critical size for the marine carbon cycle is roughly similar to the mass of carbon that human activities will likely have added to the oceans by the year 2100.

Related news article: **Mathematics predicts a sixth mass extinction**, [by Jennifer Chu, published by \*MIT News Office\*, Sept 20, 2017](#)

2. **Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines**, [by Gerardo Ceballos, Paul R. Ehrlich and Rodolfo Dirzob, published by \*Proceedings of the National Academy of Sciences of the United States\*, July, 2017](#)

Abstract:

The population extinction pulse we describe here shows, from a quantitative viewpoint, that Earth's sixth mass extinction is more severe than perceived when looking exclusively at species extinctions. Therefore, humanity needs to address anthropogenic population extirpation and decimation immediately. That conclusion is based on analyses of the numbers and degrees of range contraction (indicative of population shrinkage and/or population extinctions according to the International Union for Conservation of Nature) using a sample of 27,600 vertebrate species, and on a more detailed analysis documenting the population extinctions between 1900 and 2015 in 177 mammal species. We find that the rate of population loss in terrestrial vertebrates is extremely high—even in “species of low concern.” In our sample, comprising nearly half of known vertebrate species, 32% (8,851/27,600) are decreasing; that is, they have decreased in population size and range. In the 177 mammals for which we have detailed data, all have lost 30% or more of their geographic ranges and more than 40% of the species have experienced severe population declines (>80% range shrinkage). Our data indicate that beyond global species extinctions Earth is experiencing a huge episode of population declines and extirpations, which will have negative cascading consequences on ecosystem functioning and services vital to sustaining civilization. We describe this as a “biological annihilation” to highlight the current magnitude of Earth's ongoing sixth major extinction event.

Related news article: **Earth's sixth mass extinction event under way, scientists warn**, by [Damian Carrington](#), environment editor, *The Guardian*, July 10, 2017

**3. Accelerated modern human–induced species losses: Entering the sixth mass extinction**, research paper by [Gerardo Ceballos](#), [Paul R. Ehrlich](#), [Anthony D. Barnosky](#), [Andrés García](#), [Robert M. Pringle](#) and [Todd M. Palmer](#), published by *Science Advances*, June 19, 2015

Abstract:

The oft-repeated claim that Earth's biota is entering a sixth “mass extinction” depends on clearly demonstrating that current extinction rates are far above the “background” rates prevailing between the five previous mass extinctions. Earlier estimates of extinction rates have been criticized for using assumptions that might overestimate the severity of the extinction crisis. We assess, using extremely conservative assumptions, whether human activities are causing a mass extinction. First, we use a recent estimate of a background rate of 2 mammal extinctions per 10,000 species per 100 years (that is, 2 E/MSY), which is twice as high as widely used previous estimates. We then compare this rate with the current rate of mammal and vertebrate extinctions. The latter is conservatively low because listing a species as extinct requires meeting stringent criteria. Even under our assumptions, which would tend to minimize evidence of an incipient mass extinction, the average rate of vertebrate species loss over the last century is up to 100 times higher than the background rate. Under the 2 E/MSY background rate, the number of species that have gone extinct in the last century would have taken, depending on the vertebrate taxon, between 800 and 10,000 years to disappear. These estimates reveal an exceptionally rapid loss of biodiversity over the last few centuries, indicating that a sixth mass extinction is already under way. Averting a dramatic decay of

biodiversity and the subsequent loss of ecosystem services is still possible through intensified conservation efforts, but that window of opportunity is rapidly closing.