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Blues for a Blue Planet: Narratives of Climate Change and the Anthropocene in Nonfiction Books

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Abstract

The planetary changes associated with the Anthropocene, including climate change and extinction of species, pose severe threats to civilization, humanity, and the natural world as we know it. They also pose special challenges to the human imagination. To meet these challenges, climate change communicators use narratives. Nonfiction books intended for a general audience employ two radically different narratives: the "We can solve it" (WCSI) narrative, and the "We won't solve it" (WWSI) narrative. The WCSI narrative currently dominates mainstream media and books, but there is a strong possibility that the WWSI narrative is closer to the truth. Differences between the two narratives center on the meaning and usefulness of hope. In Elizabeth Kolbert's *The Sixth Extinction* (2014)—a WWSI narrative—wonder, lament, and understanding replace hope. Strategies of nonattachment also fulfill psychological functions. A WWSI perspective provides a much-needed complement to the triumphant narrative inherent in most mainstream popular science.

Keywords: climate change, the anthropocene, hope, optimism, nonattachment, grief, narrative, nonfiction, Elizabeth Kolbert, *The Sixth Extinction*

In an episode of the HBO series *The Newsroom* (Poul 2014), news anchor Will McAvoy performs a live interview with Richard Westbrook, a (fictional) climate scientist and deputy assistant administrator of the Environmental Protection Agency (EPA). The interview does not go as interviews with climate scientists usually go. Westbrook is on the air to comment on an EPA report showing that the amount of carbon dioxide in the atmosphere, as measured at the Mauna Loa Observatory in Hawaii, had just reached 400 ppm (parts per million). McAvoy asks Westbrook to explain the implications of this: "Just so we know what we're talking about, if you were a doctor and we were the patient, what's your prognosis? A thousand years? Two thousand years?" Westbrook replies: "A person has already been born who will die due to catastrophic failure of the planet." McAvoy and the people in the control room are caught off guard. McAvoy goes on to try to elicit reasons for hope from Westbrook, but Westbrook continues to cite data and use analogies to argue that it is already too late: catastrophic climate change will ensue shortly, and civilization will collapse. Toward the end of the interview, a visibly annoyed McAvoy spells out the problem: "Mr. Westbrook, we want to inform people, but we don't want to alarm them. Can you give us a reason to be optimistic?" Westbrook replies: "Well, that's the thing, Will, Americans are optimistic by nature. And if we face this problem head-on, if we listen to our best scientists and act decisively and passionately, I still don't see any way we can survive." McAvoy then ends the interview abruptly.

This interview captures the difficulties in understanding anthropogenic climate change and its potential consequences. Concerned scientists and observers frequently note the

"science–action gap"—the gap between the current use of fossil fuels on the one hand and what science tells us about the nature of the climate system and the biosphere of planet Earth on the other hand (e.g., Howe 2014; IPCC 2014; Moser and Dilling 2014). Widespread awareness of the science–action gap has been present since 1988, when mainstream media in the United States covered global warming extensively and James Hansen testified to the dangers of global warming at a congressional hearing (Weart [2003] 2008, 149–52). Since then, the gap has only widened. But in addition to the science–action gap, there is a gap that could be called the "reality–imagination gap." Climate change, along with the wider changes in planetary conditions associated with the Anthropocene (Lewis and Maslin 2015), presents us with deep conceptual, imaginative, and emotional challenges. It confronts us with counterintuitive causal processes, such as everyday behavior having unintended consequences on geological timescales; it prompts us to make sense of ourselves as a species that impacts atmospheric chemistry and biodiversity on a planetary scale; and it forces us to struggle with the emotional implications of living in an anthropogenic mass extinction event.

The reality–imagination gap is not restricted to climate change; it exists, in various forms, in comprehension and communication of science generally. This gap is due to a partial mismatch between science and the human mind. Science is, of course, possible; it builds upon evolved cognitive capacities (Atran 1990; Wilson 1998; Carruthers et al. 2002). But at the same time, the methods and results of science (e.g., nonteleological explanations, the age of the Earth) are often counterintuitive and difficult to grasp (Wolpert 1992; Boyer and Barrett 2016; Shtulman 2017). Science communicators face a balancing act: on the one hand, they must present science as correctly as possible; on the other hand, they must present science in a way that is appealing and comprehensible to the human mind. The challenges inherent in science communication generally are also present in the case of climate change. But there are additional challenges in this case: climate change threatens to disrupt both civilization and the natural world as we know it. The profundity of these threats is difficult to grasp. We are evolved to deal with immediate, physical threats, not slowly accumulating, abstract threats (Marshall 2014, 46–64; Stoknes 2015, 27–53). We are an extremely social species; most people are overwhelmingly preoccupied with the minds and actions of other people (Haidt 2012; Henrich 2016), not changes in Earth's atmosphere and biodiversity. Optimism bias is pervasive among humans, leading people to underestimate the likelihood of negative events (Sharot 2011). Functioning societies likewise rely on optimism, ensuring their citizens that the stability necessary for the functioning of everyday life persists (Bennett 2011, 2015). These psychological tendencies conspire to make the reality and severity of climate change difficult to imagine, and they pose challenges for climate change communication.

The humor of the Westbrook interview is largely due to a play with optimistic conventions of climate change communication. News coverage of climate change varies with location and time, ranging from denialist narratives, to depictions of a (nonexistent) debate within the scientific community as to whether anthropogenic climate change is real, to reflections of the scientific consensus (Cook et al. 2016) that anthropogenic climate change is indeed real (Boykoff and Boykoff 2004; Oreskes and Conway 2010; Boykoff 2011; Mayer 2012; Schäfer and Schlichting 2014; Brüggemann and Engesser 2017). But even in climate change reporting by news outlets that take climate change seriously, the message is virtually never as bleak as Westbrook's. This pattern recurs in nonfiction books intended for a general audience. When human response is mentioned, climate change is most often construed

as a problem that can be solved. Mike Hulme calls this "the 'problem–solution' framing of climate change" (Hulme 2009, 328). By contrast, Westbrook's account could be called a "problem–no solution" framing. The "problem–solution" framing is certainly the most comforting of the two, since it implies that humanity is in control of the situation. But given the rate and amount of planetary change at present, it is highly possible that the "problem–no solution" framing is closer to the truth.

Rather than "framing" I use "narrative" to discuss these approaches. By so doing I wish to emphasize that authors of nonfiction books make use of characters, events, and facts to construct stories about climate change and the Anthropocene (cf. Heise 2008; Kluwick 2014; Murphy 2014; Smith and Howe 2015; Heise 2016). This is no accident: narrative form is central for human cognition and communication (Tooby and Cosmides 2001; Boyd 2009; Oatley 2011; Gottschall 2012; McAdams 2016; Carroll 2017; Jacobs and Willems 2017). Broadly speaking, one can identify two main narratives of the environmental crisis: the "We can solve it" narrative (the WCSI narrative) (I borrow this term from Magnús Örn Sigurðsson [2014]); and the "We won't solve it" narrative (the WWSI narrative). In my usage of the term, "solvable" refers to the assumption that it is possible to prevent the climate system from changing so catastrophically that the conditions necessary for maintaining civilization and/or habitat for the human species are lost. Comparing and discussing these narratives is relevant not only in understanding the environmental crisis, but also in understanding its conceptual, imaginative, and emotional implications.

THE "WE CAN SOLVE IT" NARRATIVE

The WCSI narrative recurs in most nonfiction climate change books intended for a general audience. Al Gore's influential film and book *An Inconvenient Truth* (2006) displays this structure, as do many other major books, including Tim Flannery's *The Weather Makers* (2005), Mark Lynas's *Six Degrees* (2007), James Hansen's *Storms of My Grandchildren* (2009), and Naomi Klein's *This Changes Everything* (2014). The genre is diverse in terms of topics, ranging from psychology (e.g., Marshall 2014) to equity issues (e.g., Klein 2014) to geopolitics (e.g., Dyer 2010) to climate science (e.g., Flannery 2005). Though virtually all solutions include reducing emissions of greenhouse gases, they vary with regard to exactly how this can be done and the extent to which society needs to be restructured. But there is a common denominator: the assumption that it is possible to save civilization and/or humanity. This does not imply that the various authors in this category are equally hopeful. On the one end of the spectrum, there are extreme optimists like Gore. Gore ended *An Inconvenient Truth* on a cautiously hopeful note, and in 2016, detailing the rapid growth in sustainable energy markets since 2006, he was more confident than ever: "It is clear that we will ultimately prevail" (Gore 2016). More commonly, though, the belief in solvability is increasingly accompanied by a frail kind of optimism. Peter Wadhams, a leading expert on sea ice and the Arctic, published a book in 2016 that illustrates the ever-thinning thread of hope: *A Farewell to Ice*.

The first twelve chapters of *A Farewell to Ice* are devoted to explaining the fundamentals of climate science and the severity of the crisis, with a particular focus on ice and the Arctic. Wadhams's stated purpose is "to explain these dramatic changes [in the Arctic], and how and why the loss of Arctic ice is a threat to us all, not just an interesting change happening in a remote part of the world" (Wadhams 2016, 4). As the title intimates (the Hemingway reference aside), the book is also a personal farewell. Having spent four decades studying the Arctic in the field, Wadhams recounts anecdotes from his professional life and expresses sadness for the disappearance of the ice. The two concluding chapters are devoted to politics and potential

solutions to the crisis. The final chapter is forthright with its purpose: "A Call to Arms" (192–206). Wadhams argues that the only way to prevent catastrophic climate change is to develop technology that can remove carbon dioxide directly from the atmosphere and to deploy it on a massive scale. Even reducing emissions to zero is not enough. He is well aware that such a technology, at the scale required, does not exist—but, as he puts it, "if we don't solve it, we are finished" (206). Thus, even though the optimism is of the weakest kind, it is still there.

A page count reveals that about 85% of *A Farewell to Ice* is devoted to climate science and the climate crisis. Only about 15% of the book is devoted to solutions. Susanne C. Moser and Lisa Dilling argue that this kind of ratio between crisis and solutions is typical (though not universal) in climate change communication. They call it "mobilization by fear" (Moser and Dilling 2014, 164–65), describing it as one of the fundamental assumptions behind climate change communication. Many scholars side with Moser and Dilling in arguing that it is a faulty assumption: rather than inspire action, fear tends to be paralyzing. Thus, a different framing has been suggested, focused more on positive strategies and positive effects of climate engagement. This could lead to empowerment rather than paralysis (Hulme 2009; Marshall 2014; Stoknes 2015).

As many of these scholars point out, though, there are also risks associated with this strategy: a too heavy focus on positive aspects may downplay the real dangers of climate change. Some caution that unrealistic hope may be counterproductive (e.g., Stoknes 2015). Randolph M. Nesse likewise argues that not all hope is good: "Much real depression is caused by the inability to give up a useless hope" (Nesse 1999, 431). The crucial question is what kind of hope—if any—is justified and useful in the present situation. This question is unanswerable without taking the relevant science into account. Naturally, there are challenges involved in doing this: science is under constant development; it is impossible to predict the precise trajectory of a system as complex as the climate system and the biosphere, especially with regard to nonlinear change; and even if one only considers the existing science, it is difficult to get a clear overview, because the amount of studies is vast and climate research is multidisciplinary in nature. Already in 2009, A. Barrie Pittock quipped: "Human-induced climate change is a huge, highly topical and rapidly changing subject. New books, reports and scientific papers on the subject are appearing with amazing frequency. It is tempting to say that if they were all piled in a heap and buried underground the amount of carbon so sequestered would solve the problem" (Pittock 2009, xiii). This needs to be kept in mind as we proceed.

The Anthropocene and the Human Mind

The challenges do not stop with rapidly rising amounts of research. Getting a sense of the rate and amount of change that the planet is undergoing at present is probably more challenging still. Marine populations have declined by 49% globally since 1970 (WWF 2015, 6). Phytoplankton, responsible for producing about 70% of the oxygen in the atmosphere (Sekerci and Petrovskii 2015), are estimated to have declined by about 1% per year over the past century (Boyce et al. 2010). Oxygen levels in the oceans have dropped by more than 2% globally since 1960 (Schmidtko et al. 2017). Current rates of species extinction are estimated to be 1,000 times higher than the natural background rates of extinction, with future rates of 10,000 times higher considered likely (De Vos et al. 2014; Pimm et al. 2014). Researchers conclude that we are in the early phases of the sixth mass extinction (Ceballos et al. 2015). Habitat is decreasing rapidly for wildlife globally (Wilson 2016). Meanwhile, the human population has increased from an estimated 5 million at the start of the agricultural revolution (Hawks et al. 2000, 7) to 7.5 billion

today (worldometers 2017). Humans and their domesticated animals now make up more than 97% of terrestrial mammalian biomass (Smil 2013, 224–29). The level of carbon dioxide in the atmosphere—409.65 ppm as of May 2017 (NOAA 2017)—is higher than it has been for at least 2.1 million years (Hönisch et al. 2009), possibly as much as 25 million years (Palmer 2015). The rate at which it is increasing is also unprecedented. Wadhams observes: "We are injecting greenhouse gases into the atmosphere far faster than any known natural event, even an extreme one like an asteroid impact" (Wadhams 2016, 28). As a consequence, since 1970 global average temperature has been rising 170 times faster than the natural background rate. That rate of increase is particularly striking considering that global average temperature was declining by 0.01°C per century prior to the Industrial Revolution (Gaffney and Steffen 2017). It is even more striking considering that one of the side effects of industrial activity—the production of aerosols, or small particles—has had a significant cooling effect over the past century, which means that temperatures would have been even higher without these aerosols in the atmosphere (Storelvmo et al. 2016; Zhang et al. 2016). All in all, the postwar era has been called "the great acceleration": an exponential increase of human population and human activity coupled with an exponential increase of stressors on the Earth System (Steffen et al. 2015).

According to many researchers, these changes—and many more like them—are sufficient to justify declaring the dawn of a new geological epoch: the Anthropocene (Crutzen and Stoermer 2000; Steffen et al. 2011; Lewis and Maslin 2015). Decision by the International Union of Geological Sciences on whether to formally adopt the term is still pending, but it is clear that the changes are massive and unprecedented in human history. And the changes will continue.

Although the 2015 Paris agreement is lauded by some as a political step forward (e.g., Frank 2016), it is widely recognized to be insufficient. Even if it were implemented to the letter, its target of limiting global warming to 2°C will not be reached (Rogelj et al. 2016). In other words: reducing emissions is not enough. Technology is needed to counteract the warming (geoengineering) or to remove carbon dioxide from the atmosphere (carbon dioxide removal, or CDR). In fact, large-scale use of such technologies is assumed by the IPCC (Intergovernmental Panel on Climate Change) in their pathways leading to global average temperature increases at or below 2°C (Anderson and Peters 2016). But known geoengineering methods are likely to be both ineffective and dangerous (Kleidon and Renner 2013; Ferraro et al. 2014; Keller et al. 2014). CDR technologies do not exist at the required scales and come with problems of their own (Cao and Caldeira 2010; Mathesius et al. 2015; Anderson and Peters 2016). Furthermore, the Paris agreement stipulates that we should aim at limiting global warming to 1.5°C above preindustrial levels. However, due to a time lag in the climate system between emissions of carbon dioxide and fully realized temperature effects, the effects of the emissions of at least the past 10 years are yet to be manifested (Ricke and Caldeira 2014; Zickfield and Herrington 2015). The time lag guarantees that even if we were to stop emissions immediately, temperatures would continue to rise. Based on emissions up to the early 2000s, the committed warming was calculated to be about 0.5°C (Meehl et al. 2005) or 0.6°C (Hansen et al. 2005). The emissions since then exceed the emissions of the 10 to 15 years before 2000 (Boden et al. 2017). In 2016, global average temperature was 1.26°C above the 1880–1920 baseline (Hansen et al. 2017) and 1.29°C above the 1850–1900 baseline (Berkeley Earth 2017). (The 2015–16 El Niño event accounts for about 0.2°C of this rise [Met Office 2016].) These figures combine to show that even if we were to stop emissions immediately, we are already locked in for more than 1.5°C rise in temperature above preindustrial

levels. But of course, we are nowhere near stopping emissions.

Meanwhile, in a grimly ironic twist to the tale, scientists are demonstrating that the climate system is more sensitive than previously thought. A 2°C rise is likely not safe at all, but is in fact likely to be very dangerous (Anderson and Bows 2011; Hansen et al. 2013; Drijfhout et al. 2015; Hansen et al. 2016). James Hansen and colleagues (2013, 15) put the upper limit closer to 1°C and call 2°C "disastrous." This is largely due to self-reinforcing feedback loops, also called positive feedback loops. In the stable temperatures of the Holocene, these feedback loops were inactive. But with rising temperatures, they are becoming active and will raise temperatures faster and further than would carbon dioxide alone. There are feedback loops acting in the opposite direction also—negative feedback loops—and they do damp the warming, but not sufficiently. Wadhams (2016, 105) lists 10 positive feedback loops associated with the Arctic, but there are many more (Drijfhout et al. 2015). A particularly ominous feedback loop that has received much attention is methane in the Arctic. There are vast amounts of methane stored in shallow seabeds in the Arctic Ocean and in permafrost in the Arctic region. As temperatures rise, this methane begins to leak into the atmosphere, which causes increased warming, leading to more methane release, and so on. Methane is a much more powerful greenhouse gas than carbon dioxide on short timescales, so if this feedback loop grows stronger—methane release has already been observed—a very rapid temperature rise may occur in the near future (Shakhova et al. 2010; Frederick and Buffett 2014; Schuur et al. 2015; Wadhams 2016, 121–33). Higher temperatures activate and amplify even more positive feedback loops, so given enough initial warming it is possible that the climate system may spiral out of control, warming even more rapidly and extensively than at present (Lynas 2007; Pearce 2007; Friedrich et al. 2016; Hansen et al. 2016, 3801). This would have devastating effects on food production and civilization, and it could drive the human species to extinction (Lynas 2007; Tickell 2008; Schlenker and Roberts 2009; Dyer 2010; Garrett 2012; Jamail [2013] 2014; McMichael et al. 2014; Motesharrei et al. 2014; Barlow et al. 2015; Doré 2015).

It is worth reiterating that there are uncertainties in projections about the future, especially regarding the feedback loops. There are historical precedents, though, imperfect as they may be. The Earth has undergone extinction events in the past, most of them associated with rapid changes in climate and oceanic chemistry and one with an asteroid impact (Ward 2009, 53–90; Brannen 2017). Furthermore, as Keynyn Brysse and colleagues show in an article from 2013, scientists are usually too conservative in their projections, particularly in the IPCC reports. The climate system has already changed faster than projected. Brysse and colleagues call this tendency "erring on the side of least drama" (Brysse et al. 2013). Several other prominent scientists likewise caution that the IPCC reports are conservative and optimistic, pointing out that the reports among other things underestimate sea level rise and do not take positive feedback loops sufficiently into account (e.g., Romm 2012; Mann 2013; Rahmstorf 2013; Anderegg et al. 2014; Anderson 2015; Hansen et al. 2016).

Even with historical precedents in mind, we are entering truly unprecedented territory (e.g., Barnosky et al. 2012; Hönisch et al. 2012; Smith et al. 2015; Payne et al. 2016; Wilson et al. 2016; Zeebe et al. 2016). Yet the amount and rapidity of change is hardly detectable for most people, at least so far. The human mind is exceptionally ill-equipped to fathom and deal with climate change. Timescales collide: on geological timescales, climate change is happening unprecedentedly fast; on human timescales, many aspects of climate change are (so far) barely noticeable. And where they are noticeable—in the severity of storms, droughts, and so on—they manifest themselves as weather,

not as "climate change." Storms elicit immediate threat response; climate change does not.

If the effects of climate change are difficult to fully comprehend, so too are the causes. The fundamental causes of the environmental crisis—fossil fuel use, habitat destruction, pollution, resource depletion, hunting—are forms of human activity. Yet in ordinary life we do not normally think of our activities as destructive, because they are side effects of what counts as normal behavior in our society. We tend to align our behavior and attitude with people in our in-group (Haidt 2012; Marshall 2014, 26–32), and if their habits cause high emissions of carbon dioxide, so will, most likely, ours. It is exceptionally difficult to lead a carbon-neutral life in today's affluent societies, both for practical and social reasons. And even if a few people are able to do it, it does not matter much, because the overwhelming majority are high emitters.

The carbon footprint of people in affluent societies is much greater than the footprint of those in less affluent societies, as is the footprint of wealthy people in a given society compared to poor people in the same society. In addition, poor countries and poor people tend to be affected by climate change first and most severely (Klein 2014; Malm and Hornborg 2014; Bonneuil and Fressoz 2016). These are issues of equity that have intrinsic ethical importance, but they do not bear directly on difficulties in comprehending the implications or the causes of climate change.

Unperceivable causal links and temporal displacement of effects run together with optimism bias and social optimism. According to Tali Sharot, studies consistently show that about 80% of the population exhibit optimism bias. The main exceptions are people suffering from mild depression (no bias) and severe depression (pessimism bias) (Sharot 2011, R942). Furthermore, as Oliver Bennett shows, optimism is a pervasive attitude in functioning societies: there is an "optimism of everyday life" necessary for society to function. As a consequence, major social institutions, such as government bodies, religion, and the business sector, all display a fundamentally optimistic attitude (Bennett 2011, 2015). On both an individual and a social level, optimism can be said to temporarily mask the consequences of our lifestyles. We tend to think that we will avoid disasters and that the future will be similar to the present. Science disagrees.

I am not qualified to make a robust scientific assessment of whether we actually *can* solve the crisis. But given political and social inertia and the psychological profile of the human species, I think that there is a strong possibility that we *will not* solve it. Consequently, it is important to consider alternatives to the WCSI narrative. There are emerging emotional needs that the WCSI narrative is largely unable to meet. Clive Hamilton, in a book aptly named *Requiem for a Species*, expresses this need succinctly: "When a loved one is diagnosed with terminal illness, many people embark on a process of anticipatory mourning; for those who confront the facts and emotional meaning of climate change, the 'death' that is mourned is the loss of the future" (Hamilton 2010, 212). Climate change and the Anthropocene not only potentially threaten one's own life, but, more profoundly, they threaten one's family and community, humanity, and the natural world as we know it. Thus, I now turn to a book that is an example of the "We won't solve it" narrative.

A "We won't solve it" Narrative: Elizabeth Kolbert's The Sixth Extinction

Journalist and author Elizabeth Kolbert first wrote about climate change at length in *Field Notes from a Catastrophe: Man, Nature, and Climate Change* (2006). In *The Sixth Extinction: An Unnatural History* (2014), which won the Pulitzer Prize for General Nonfiction in 2015, she continues the theme of human impact on the planet but takes a broader view. Climate change, though certainly a main driver of the ongoing extinction event, is only a recent and

drastically accelerated instance of a much older pattern. Very loosely and very generally, this pattern could be described as follows: biodiversity is inversely correlated with human presence and activity.

As with climate change, this pattern is undetectable in a direct sense to an individual human being. The extinction of a species does not announce itself; rather, individuals of a vanishing species are simply more and more difficult to find, until they are no longer found. The idea that humans cause species to go extinct is similarly counterintuitive, because it is often a side effect of what counts as normal behavior in a given culture. Certainly, human-caused extinction became a widespread notion during the second half of the twentieth century, which means that to many people it is no longer an unfamiliar phenomenon (Heise 2016, 32). But understanding something abstractly and experiencing it directly and vividly are different. The power of a piece of science writing like *The Sixth Extinction* is that it can lessen, if not eliminate, the distance between abstract understanding and vivid experience.

The Sixth Extinction tells the story of the ongoing extinction event in 13 chapters and a prologue. To break the familiarity of direct sense experience and an anthropocentric world view, the prologue distances the reader from the natural perspective of a member of *Homo sapiens*: "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" (Kolbert 2014, 1). The prologue goes on to briefly sketch human history as though from the outside. Early on, humanity's effects on other species are highlighted: "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" (2). Eventually, after thousands of years, "the species, no longer so new, has spread to practically every corner of the globe" (2). As the story continues to modern times and the species has given itself a name, the rate of expansion and impact increases, with global consequences: "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" (2).

The distancing effect of the prologue contrasts with Kolbert's presence and direct observations in the succeeding chapters. These chapters detail aspects of the Anthropocene, focusing on particular species and their habitats as well as general principles and scientific theories. Kolbert, in her narrative, travels around the world and talks to scientists and conservationists, visiting places where research is done and conservation efforts are made. This enables the reader to view the extinction event close at hand, filtered through the observations and reactions of scientists, conservationists, and Kolbert herself. The total effect of the 13 chapters is an emerging story of the ongoing extinction event as it is both caused by and chronicled by a single species.

In contrast to WCSI books, *The Sixth Extinction* does not set out to inspire action. There is no call to arms. Rather, the purpose is to "try to convey . . . the excitement of what's being learned as well as the horror of it. My hope is that readers of the book will come away with an appreciation of the truly extraordinary moment in which we live" (Kolbert 2014, 3). In other words, the book does not aim at mobilization through fear; its main purpose is to understand and convey what is happening. Kolbert

seldom discusses her feelings. She quotes scientists and conservationists who, most of them, are increasingly worried and sad. She records moments of wonder, sadness, and fear that she experienced during her travels. But by and large, she leaves the emotional response to the reader.

Hope is notably lacking in *The Sixth Extinction*. It is not that Kolbert necessarily thinks that the current crisis cannot be halted to *some* degree, as conservation efforts show. But it is not enough: "To argue that the current extinction event could be averted if people just cared more 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" (Kolbert 2014, 266). And change it we do, all of us, directly or indirectly: "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 Amazon gripping an ax, or, better still, you can picture yourself, holding a book on your lap" (266). This illustrates the pervasiveness of the problem: even the mundane and seemingly innocent act of reading a book depends upon a set of conditions—resource extraction, infrastructure maintenance, production, transportation—that threaten other species to the point of extinction. Kolbert argues that this has been the case for the entirety of human history: due to characteristically human traits like restlessness, creativity, and cooperation, our everyday activities impact other species negatively. But industrial civilization has increased the amount of impact drastically. And given that we probably will not dismantle industrial civilization voluntarily, it seems quite likely that the extinction event will continue at a rapid pace. How far? Kolbert is reluctant to speculate. She does discuss the possibility that *Homo sapiens* will be one of the victims of the Sixth Extinction, pointing out that it is a recurring pattern in prior mass extinction events that past success is not a guarantee of survival. She also points out that we, adaptable as we may be, need functioning ecosystems to provide us with clean air, water, and food—a basic fact of life too easily forgotten in affluent, industrialized societies. But she does not predict the future. Instead, she leaves the reader with the following words:

> Obviously, the fate of our own species concerns us disproportionally. But at the risk of sounding anti-human—some of my best friends are humans!—I will say that it is not, in the end, what's most worth attending to. Right now, in this amazing moment that to us counts as the present, 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 will continue to determine the course of life long after everything people have written and painted and built has been ground into dust and giant rats have—or have not—inherited the earth. (268–69)

Thus, *The Sixth Extinction* does not end on a hopeful or optimistic note. Kolbert does attempt to capture the remarkable character of our moment in time, but she does not envision the extinction event halting in the near future, nor does she conjure up images of a lost paradise in which humans lived in harmony with nature. There is both wonder ("this amazing moment") and lament ("unfortunately") in her outlook, but there are no solutions. As she puts it in an interview, reporting what scientists have told her: "We're the asteroid" (Wiener 2014).

HOPE AND MEANING

The temperatures will keep rising in the coming years, the climate will keep changing, and the extinction event will continue. The effects will be increasingly felt. The only question is how rapidly and how severely. Consequently, there is an increasing need for people to cope with this reality. The psychiatrist Lise Van Susteren has used the term "pretraumatic stress" to describe the psychological effects of climate change on

some people, particularly climate scientists and activists. The symptoms are similar to those exhibited by sufferers of post-traumatic stress: anger, panic, and obsessive and intrusive thoughts (Richardson 2015, 85). Climate change is increasingly being linked to cases of depression—either through anticipation of future disasters or through already occurring disasters caused or exacerbated by climate change (APA 2012; Coyle and Van Susteren 2012; Thomas 2014; Clayton et al. 2015). There is an increasing recognition for the need to grieve (Hamilton 2010; Marshall 2014; Stoknes 2015; Harland 2016; Head 2016).

It seems intuitive that climate change should have the potential to cause pretraumatic stress and depression. In general, meaning in life and hope are positively correlated with emotional well-being and goal-directed behavior and negatively correlated with depression and demoralization (Clarke and Kissane 2002; Snyder 2002; Steger et al. 2009; Kleftaras and Psarra 2012; Nelissen 2017). Climate change profoundly threatens both meaning and hope through threatening to disrupt the continuation and well-being of oneself, one's community, humanity, and the natural world as we know it. On an individual level, the WCSI narrative can be construed as a way to counteract the loss of meaning and hope and the feelings of powerlessness. It does so by encouraging people to take action against climate change—either in a minor way (e.g., change light bulbs) or in a major way (e.g., become an activist). Where the WCSI narrative is increasingly falling short is precisely in view of the magnitude of the crisis and the continued lack of sufficient action on a global scale. Insofar as the WCSI narrative grounds its reasons for hope on solving the crisis, the hope may become the kind of useless hope that Randolph Nesse warns against. A useless hope easily turns into despair. Indeed, hope and despair may be seen as two sides of the same coin: "They are intrinsically intertwined partners in the dance of desire, differing only in whether or not the object of desire is more or less likely to be reached" (Nesse 1999, 431).

But although hope is positively correlated with well-being for most people, it is not a necessary precondition for well-being. An alternative to hope is detachment from outcome. Nonattachment is a core aspect of meditation and mindfulness, which can increase emotional well-being (Davis and Hayes 2011; Montero-Marin et al. 2016). Stoic philosophy similarly emphasizes nonattachment (Graver 2007; Irvine 2009). Nonattachment is not the same as dissociation, denial, or inaction; it is, rather, about accepting a situation as it is. The WWSI narrative can be construed along these lines: it detaches itself from the hope that the climate crisis will be solved and focuses instead on the here and now. Kolbert, as we saw, focuses on understanding, wonder, and lament. The aforementioned Clive Hamilton's *Requiem for a Species* similarly focuses on understanding, and also grief, mourning, and acceptance. Hamilton still advocates action, but more for ethical and psychological reasons than for the hope that it will prevent catastrophic climate change.

The WWSI narrative is quite rare in mainstream nonfiction climate books. There are other venues where versions of it are more common, however. One such venue is works by activists and critics of civilization like Derrick Jensen (2006a, 2006b, 2016) and Guy McPherson (2013, 2016). These authors argue that civilization is fundamentally unsustainable and destructive to the environment. They further argue that collapse of civilization is inevitable and that the sooner civilization collapses the better, because, as Jensen puts it, "the sooner civilization comes down (whether or not we help it crash) the more life will remain afterwards to support both humans and nonhumans" (2006a, 305). Jensen is a prolific author and has been described as "the poet-philosopher of the ecology movement" (Goodman 2010). McPherson, who is professor emeritus of natural resources and ecology and evolutionary biology at the University of Arizona, has gained

some traction over the past few years for his prediction that humanity will become extinct in the very near future (Curry 2013; Jamail [2013] 2014; Revkin 2015). He uses the term "Near-Term Human Extinction" and argues that temperatures will increase exponentially over the coming years due to positive feedback loops. This will, he predicts, cause habitat for humans to disappear within the coming decade (McPherson 2017). McPherson explicitly positions himself against the usefulness of hope and favors nonattachment and compassion.

Another major venue for versions of the WWSI narrative is fiction. "Climate fiction" (cli-fi) has emerged over the past decade or so as a distinct genre (Trexler 2015; Johns-Putra 2016). Many cli-fi stories take a negative view of the future: Adeline Johns-Putra notes that "overwhelmingly, climate change appears in novels as part of a futuristic dystopian and/or postapocalyptic setting" (Johns-Putra 2016, 269). It is particularly illuminating to compare this tendency with the dominance of the WCSI narrative in nonfiction treatments of climate change. The differences in outlook could possibly be explained through an important difference between the functions of fiction and nonfiction. A plausible hypothesis for one of the adaptive functions of fiction is that fiction allows people to calibrate and practice emotional, cognitive, and behavioral responses and strategies through vicarious experience in safe environments (Pinker 1997; Scalise Sugiyama 2001; Tooby and Cosmides 2001; Boyd 2009; Clasen 2012; Carroll et al. 2017). The idea that organisms need true information is usually seen as the default position, with fiction being the phenomenon in need of explanation (Cosmides and Tooby 2000; Boyd 2009; Gottschall 2012). Against this background, the difference between cli-fi and nonfiction climate change books becomes clearer. In fiction, worst-case scenarios and life-threatening situations have a strong appeal. Emotional investment often shifts to the point of view of survivors within the altered environment, and fiction offers emotional distance from reality. But in nonfiction, we generally want to hear good news, because our future depends on social and climactic stability. This desire, in combination with optimism bias, social optimism, and the counterintuitive aspects of climate change, provides a plausible explanation for the relative absence of WWSI narratives in mainstream nonfiction climate change books compared with cli-fi stories. The appeal of the WCSI narrative for people embedded in and dependent upon the civilization that is causing climate change is, in general, greater than the appeal of the WWSI narrative, despite the steadily growing likelihood that we will not solve the crisis.

In a broader perspective, a WWSI narrative like Kolbert's complements the conception of humanity that is prevalent in much popular science, particularly popular physics and astronomy. Carl Sagan's paradigmatic television series and book *Cosmos* (1980), for instance, presents the history of science as a triumphant narrative wherein humanity achieves an ever greater understanding of itself and the universe. To paraphrase Kolbert: this is not wrong, exactly; still, it leaves out a major part of the story. Sagan certainly discusses imminent threats such as environmental destruction and the risk of nuclear war. Indeed, he is more acutely aware of such threats than most popularizers of physics and astronomy. But he does not emphasize the extent to which modern science is inseparable from the infrastructure and resource consumption that is at the root of environmental destruction. To be fair, there are many aspects of the environmental crisis of which Sagan was not aware, simply due to the advancement of science and the rapid escalation of the environmental crisis since 1980. But the narrative as such is still prevalent in popular science. Modern science requires advanced computers, measuring equipment, communications technology, transportation systems, and so on. Even though scientific use of technology could be viewed as an important and valuable use of technology, it is still inextricably intertwined with the set of

conditions that causes environmental destruction. The point is not that science should be abandoned; on the contrary, as long as civilization persists we need science more than ever, to understand what is going on. The point is rather that both aspects of science need to be taken into account in narratives of human history. Without such a balance, these narratives risk succumbing to the same kind of human self-adoration that science has fought so hard to counteract. Our species certainly is a success story in terms of geographical spread, biomass, and scientific understanding. But the same traits that combine to make our species so successful not only spell disaster for a host of other species—they may also, thanks to the discovery of fossil fuels, spell disaster for our own.

Imagination has only a limited power in our present situation. We can imagine the likely outcome of our situation, at least to some degree. We can imagine ourselves as the equivalent of an asteroid hitting the Earth and causing a mass extinction. Through a book like *The Sixth Extinction*, we can imagine it in some detail and get a sense of what is happening. But the imagination seems powerless to veer the asteroid off course. The asteroid may be unstoppable. In that case, the WWSI narrative may at least provide aid in bracing for impact.

WORKS CITED

Anderegg, William R. L., Elizabeth S. Callaway, Maxwell T. Boykoff, Gary Yohe, and Terry L. Root. 2014. "Awareness of Both Type 1 and Type 2 Errors in Climate Science and Assessment." *Bulletin of the American Meteorological Society* 95 (9): 1445–51. doi:10.1175/BAMS-D-13-00115.1.

Anderson, Kevin. 2015. "Duality in Climate Science." *Nature Geoscience* 8:898–90. doi:10.1038/ngeo2559.

Anderson, Kevin, and Alice Bows. 2011. "Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 369 (1934): 20–44. doi:10.1098/rsta.2010.0290.

Anderson, Kevin, and Glen Peters. 2016. "The Trouble with Negative Emissions: Reliance on Negative-Emissions Concept Locks in Humankind's Carbon Addiction." *Science* 354 (6309): 182–83. doi:10.1126/science.aah4567.

APA. 2012. *Psychology and Global Climate Change: Addressing a Multifaceted Phenomenon and Set of Challenges: A Report of the American Psychological Association Task Force on the Interface between Psychology and Global Climate Change*. American Psychological Association. http://www.apa.org/science/about/publications/climate-change.aspx.

Atran, Scott. 1990. *Cognitive Foundations of Natural History: Towards an Anthropology of Science*. Cambridge: Cambridge University Press.

Barlow, K. M., B. P. Christy, G. J. O'Leary, P. A. Riffkin, and J. G. Nuttall. 2015. "Simulating the Impact of Extreme Heat and Frost Events on Wheat Crop Production: A Review." *Field Crops Research* 171:109–19. doi:10.1016/j.fcr.2014.11.010.

Barnosky, Anthony D., Elizabeth A. Hadly, Jordi Bascompte, Eric L. Berlow, James H. Brown, Mikael Fortelius, Wayne M. Getz, John Harte, Alan Hastings, Pablo A. Marquet, Neo D. Martinez, Arne Mooers, Peter Roopnarine, Geerat Vermeij, John W. Williams, Rosemary Gillespie, Justin Kitzes, Charles Marshall, Nicholas Matzke, David P. Mindell, Eloy Revilla, and Adam B. Smith. 2012. "Approaching a State Shift in Earth's Biosphere." *Nature* 486:52–58. doi:10.1038/nature11018.

Bennett, Oliver. 2011. "Cultures of Optimism." *Cultural Sociology* 5 (2): 301–20. doi:10.1177/1749975511401270.

_____. 2015. *Cultures of Optimism: The Institutional Promotion of Hope*. Basingstoke: Palgrave Macmillan.

Berkeley Earth. 2017. "Global Warming 2016." Berkeley Earth. Accessed March 5, 2017. http://berkeleyearth.org/global-warming-2016/.

Boden, T. A., G. Marland, and R. J. Andres. 2017. "Global, Regional, and National Fossil-Fuel CO_2 Emissions." Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, TN. doi:10.3334/CDIAC/00001_V2017.

Bonneuil, Cristophe, and Jean-Baptiste Fressoz. 2016. *The Shock of the Anthropocene: The Earth, History and Us*. Translated by David Fernbach. London: Verso.

Boyce, Daniel G., Marlon R. Lewis, and Boris Worm. 2010. "Global Phytoplankton Decline over the Past Century." *Nature* 466:591–96. doi:10.1038/nature09268.

Boyd, Brian. 2009. *On the Origin of Stories: Evolution, Cognition, and Fiction*. Cambridge, MA: Belknap.

Boyer, Pascal, and H. Clark Barrett. 2016. "Intuitive Ontologies and Domain Specificity." In *The Handbook of Evolutionary Psychology*, Vol. 1, *Foundations*, 2nd ed., edited by David M. Buss, 161–79. Hoboken, NJ: John Wiley and Sons.

Boykoff, Maxwell T. 2011. *Who Speaks for the Climate? Making Sense of Media Reporting on Climate Change*. Cambridge: Cambridge University Press.

Boykoff, Maxwell T., and Jules M. Boykoff. 2004. "Balance as Bias: Global Warming and the US Prestige Press." *Global Environmental Change* 14 (2): 125–36. doi:10.1016/j.gloenvcha.2003.10.001.

Brannen, Peter. 2017. *The Ends of the World: Volcanic Apocalypses, Lethal Oceans, and Our Quest to Understand Earth's Past Mass Extinctions*. New York: Ecco.

Brüggemann, Michael, and Sven Engesser. 2017. "Beyond False Balance: How Interpretive Journalism Shapes Media Coverage of Climate Change." *Global Environmental Change* 42:58–67. doi:10.1016/j.gloenvcha.2016.11.004.

Brysse, Keynyn, Naomi Oreskes, Jessica O'Reilly, and Michael Oppenheimer. 2013. "Climate Change Prediction: Erring on the side of Least Drama?" *Global Environmental Change* 23 (1): 327–37. doi:10.1016/j.gloenvcha.2012.10.008.

Cao, Long, and Ken Caldeira. 2010. "Atmospheric Carbon Dioxide Removal: Long-Term Consequences and Commitment." *Environmental Research Letters* 5 (2): 6 pp. doi:10.1088/1748-9326/5/2/024011.

Carroll, Joseph. 2017. "Minds and Meaning in Fictional Narratives: An Evolutionary Perspective." *Review of General Psychology* (April 20): 12 pp. doi:10.1037/gpr0000104.

Carroll, Joseph, Mathias Clasen, Emelie Jonsson, Alexandra Regina Kratschmer, Luseadra McKerracher, Felix Riede, Jens-Christian Svenning, and Peter C. Kjærgaard. 2017. "Biocultural Theory: The Current State of Knowledge." *Evolutionary Behavioral Sciences* 11 (1): 1–15. doi:10.1037/ebs0000058.

Carruthers, Peter, Stephen Stich, and Michael Siegal, eds. 2002. *The Cognitive Basis of Science*. Cambridge: Cambridge University Press.

Ceballos, Gerardo, Paul R. Ehrlich, Anthony D. Barnosky, Andrés García, Robert M. Pringle, and Todd M. Palmer. 2015. "Accelerated Modern Human-Induced Species Losses: Entering the Sixth Mass Extinction." *Science Advances* 1 (5): 5 pp. doi:10.1126/sciadv.1400253.

Clarke, David M., and David W. Kissane. 2002. "Demoralization: Its Phenomenology and Importance." *Australian and New Zealand Journal of Psychiatry* 36 (6): 733–42. doi:10.1046/j.1440-1614.2002.01086.x.

Clasen, Mathias. 2012. "Monsters Evolve: A Biocultural Approach to Horror Stories." *Review of General Psychology* 16 (2): 222–29. doi:10.1037/a0027918.

Clayton, Susan, Patrick Devine-Wright, Paul C. Stern, Lorraine Whitmarsh, Amanda Carrico, Linda Steg, Janet Swim, and Mirilia Bonnes. 2015. "Psychological Research and Global Climate Change." *Nature Climate Change* 5:640–46. doi:10.1038/NCLIMATE2622.

Cook, John, Naomi Oreskes, Peter T. Doran, William R. L. Anderegg, Bart Verheggen, Ed W. Maibach, Stuart J. Carlton, Stephan Lewandowsky, Andrew G. Skuce, Sarah A. Green, Dana Nuccitelli, Peter Jacobs, Mark Richardson, Bärbel Winkler, Rob Painting, and Ken Rice. 2016. "Consensus on Consensus: A Synthesis of Consensus Estimates on Human-Caused Global Warming." *Environmental Research Letters* 11 (4): 7 pp. doi:10.1088/1748-9326/11/4/048002.

Cosmides, Leda, and John Tooby. 2000. "Consider the Source: The Evolution of Adaptations for Decoupling and Metarepresentation." In *Metarepresentations: A Multidisciplinary Perspective*, edited by Dan Sperber, 53–115. New York: Oxford University Press.

Coyle, Kevin J., and Lise Van Susteren. 2012. *The Psychological Effects of Global Warming on the United States: And Why the U.S. Mental Health Care System Is Not Adequately Prepared*. National Wildlife Federation. http://www.nwf.org/~/media/PDFs/Global-Warming/Reports/Psych_Effects_Climate_Change_Full_3_23.ashx.

Crutzen, Paul J., and Eugene F. Stoermer. 2000. "The 'Anthropocene.'" *Global Change News Letter* 41:17–18. http://www.igbp.net/download/18.316f18321323470177580001401/1376383088452/NL41.pdf.

Curry, Nathan. 2013. "Some Credible Scientists Believe Humanity Is Verrrrrry Close to Destruction." *Vice*, August 22. https://www.vice.com/sv/article/near-term-extinctionists-believe-the-world-is-going-to-end-very-soon.

Davis, Daphne M., and Jeffrey A. Hayes. 2011. "What Are the Benefits of Mindfulness? A Practice Review of Psychotherapy-Related Research." *Psychotherapy* 48 (2): 198–208. doi:10.1037/a0022062.

De Vos, Jurriaan M., Lucas N. Joppa, John L. Gittleman, Patrick R. Stephens, and Stuart L. Pimm, 2014. "Estimating the Normal Background Rate of Species Extinction." *Conservation Biology* 29 (2): 452–62. doi:10.1111/cobi.12380.

Doré, Louis. 2015. "Society Will Collapse by 2040 Due to Catastrophic Food Shortages, Says Study." *The Independent*, June 22. http://www.independent.co.uk/environment/climate-change/society-will-collapse-by-2040-due-to-catastrophic-food-shortages-says-study-10336406.html.

Drijfhout, Sybren, Sebastian Bathiany, Claudie Beaulieu, Victor Brovkin, Martin Claussen, Chris Huntingford, Marten Scheffer, Giovanni Sgubin, and Didier Swingedouw. 2015. "Catalogue of Abrupt Shifts in Intergovernmental Panel on Climate Change Climate Models." *PNAS* 112 (43): E5777–E5786. doi:10.1073/pnas.1511451112.

Dyer, Gwynne. 2010. *Climate Wars: The Fight for Survival as the World Overheats*. Oxford: Oneworld.

Ferraro, Angus J., Eleanor J. Highwood, and Andrew J. Charlton-Perez. 2014. "Weakened Tropical Circulation and Reduced Precipitation in Response to Geoengineering." *Environmental Research Letters* 9 (1): 7 pp. doi:10.1088/1748-9326/9/1/014001.

Flannery, Tim. 2005. *The Weather Makers: How Man Is Changing the Climate and What It Means for Life on Earth*. New York: Groove.

Frank, Adam. 2016. "Paris Climate Agreement: Success or Failure?" NPR, January 12. http://www.npr.org/sections/13.7/2016/01/12/462753762/paris-climate-agreement-success-or-failure.

Frederick, J. M., and B. A. Buffett. 2014. "Taliks in Relict Submarine Permafrost and Methane Hydrate Deposits: Pathways for Gas Escape under Present and Future Conditions." *Journal of Geophysical Research: Earth Surface* 119 (2): 106–22. doi:10.1002/2013JF002987.

Friedrich, Tobias, Axel Timmerman, Michelle Tigchelaar, Oliver Elison Timm, and Andrey Ganopolski. 2016. "Nonlinear Climate Sensitivity and its Implications for Future Greenhouse Warming." *Science Advances* 2 (11): e1501923. doi:10.1126/sciadv.1501923.

Gaffney, Owen, and Will Steffen. 2017. "The Anthropocene Equation." *The Anthropocene Review* 4 (1): 53–61. doi:10.1177/2053019616688022.

Garrett, T.J. 2012. "No Way Out? The Double-Bind in Seeking Global Prosperity alongside Mitigated Climate Change." *Earth System Dynamics* 3 (1): 1–17. doi:10.5194/esd-3-1-2012.

Goodman, Amy. 2010. "Author and Activist Derrick Jensen: 'The Dominant Culture Is Killing the Planet . . . It's Very Important for Us to Start to Build a Culture of Resistance.'" *Democracy Now!*, November 26. Interview with Derrick Jensen. https://www.democracynow.org/2010/11/26/author_and_activist_derrick_jensen_the.

Gore, Al. 2006. *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do about It*. London: Bloomsbury.

_____. 2016. "The Case for Optimism on Climate Change." *The Huffington Post*, February 25. http://www.huffingtonpost.com/al-gore/the-case-for-optimism-on_b_9321148.html.

Gottschall, Jonathan. 2012. *The Storytelling Animal: How Stories Make Us Human*. New York: Mariner.

Graver, Margaret. 2007. *Stoicism and Emotion*. Chicago: University of Chicago Press.

Haidt, Jonathan. 2012. *The Righteous Mind: Why Good People Are Divided by Politics and Religion*. New York: Pantheon.

Hamilton, Clive. 2010. *Requiem for a Species: Why We Resist the Truth about Climate Change*. London and Washington, DC: Earthscan.

Hansen, James. 2009. *Storms of My Grandchildren: The Truth about the Coming Climate Catastrophe*. New York: Bloomsbury.

Hansen, James, Pushker Kharecha, Makiko Sato, Valerie Masson-Delmotte, Frank Ackerman, David J. Beerling, Paul J. Hearty, Ove Hoegh-Guldberg, Shi-Ling Hsu, Camille Parmesan, Johan Rockstrom, Eelco J. Rohling, Jeffrey Sachs, Pete Smith, Konrad Steffen, Lise Van Susteren, Karina von Schmuckmann, and James C. Zachos. 2013. "Assessing 'Dangerous Climate Change': Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature." *PLOS ONE* 8 (12): e81648. doi:10.1371/journal.pone.0081648.

Hansen, James, Larissa Nazarenko, Reto Ruedy, Makiko Sato, Josh Willis, Anthony Del Gieno, Dorothy Koch, Andrew Lacis, Ken Lo, Surabi Menon, Nica Novakov, Judith Perlwitz, Gary Russell, Gavin A. Schmidt, and Nicholas Tausnev. 2005. "Earth's Energy Imbalance: Confirmation and Implications." *Science* 308 (5727): 1431–35. doi:10.1126/science.1110252.

Hansen, James, Makiko Sato, Paul Hearty, Reto Ruedy, Maxwell Kelley, Valerie Masson-Delmotte, Gary Russell, George Tselioudis, Junji Cao, Eric Rignot, Isabella Velicogna, Blair Tormey, Bailey Donovan, Evgeniya Kandiano, Karina von Schmuckmann, Pushker Kharecha, Allegra N. Legrande, Michael Bauer, and Kwok-Wai Lo. 2016. "Ice Melt, Sea Level Rise and Superstorms: Evidence from Paleoclimate Data, Climate Modeling, and Modern Observations that 2°C Could Be Dangerous." *Atmospheric Chemistry and Physics* 16 (6): 3761–3812. doi:10.5194/acp-16-3761-2016.

Hansen, James, Makiko Sato, Reto Ruedy, Gavin A. Schmidt, Ken Lo, and Avi Persin. 2017. "Global Temperature in 2016." Climate Science, Awareness and Solutions (webpage at Earth Institute, Columbia University), January 18. http://csas.ei.columbia.edu/2017/01/18/global-temperature-in-2016/.

Harland, Paul W. 2016. "Ecological Grief and Therapeutic Storytelling in Margaret Atwood's *Maddaddam* Trilogy." *Interdisciplinary Studies in Literature and the Environment* 23 (3): 583–602. doi: 10.1093/isle/isw001.

Hawks, John, Keith Hunley, Sang-Hee Lee, and Milford Wolpoff. 2000. "Population Bottlenecks and Pleistocene Human Evolution." *Molecular Biology and Evolution* 17 (1): 2–22. doi:10.1093/oxfordjournals.molbev.a026233.

Head, Lesley. 2016. *Hope and Grief in the Anthropocene: Re-Conceptualising Human–Nature Relations*. London: Routledge.

Heise, Ursula K. 2008. *Sense of Place and Sense of Planet: The Environmental Imagination of the Global*. New York: Oxford University Press.

_____. 2016. *Imagining Extinction: The Cultural Meaning of Endangered Species*. Chicago: University of Chicago Press.

Henrich, Joseph. 2016. *The Secret of Our Success: How Culture Is Driving Human Evolution, Domesticating Our Species, and Making Us Smarter*. Princeton, NJ: Princeton University Press.

Hönisch, Bärbel, N. Gary Hemming, David Archer, Mark Siddall, and Jerry F. McManus. 2009. "Atmospheric Carbon Dioxide Concentration across the Mid-Pleistocene Transition." *Science* 324 (5934): 1551–54. doi:10.1126/science.1171477.

Hönisch, Bärbel, Andy Ridgwell, Daniela N. Schmidt, Ellen Thomas, Samantha J. Gibbs, Appy Sluijs, Richard Zeebe, Lee Kump, Rowan C. Martindale, Sarah E. Greene, Wolfgang Kiessling, Justin Ries, James C. Zachos, Dana L. Royer, Stephen Barker, Thomas M. Marchitto Jr., Ryan Moyer, Carles Pelejero, Patrizia Ziveri, Gavin L. Foster, and Branwen Williams. 2012. "The Geological Record of Ocean Acidification." *Science* 335 (6072): 1058–63. doi:10.1126/science.1208277.

Howe, Joshua P. 2014. *Behind the Curve: Science and the Politics of Global Warming*. Seattle: University of Washington Press.

Hulme, Mike. 2009. *Why We Disagree about Climate Change: Understanding Controversy, Inaction and Opportunity*. Cambridge: Cambridge University Press.

IPCC (Core Writing Team, R. K. Pachauri, and L.A. Meyer, eds.). 2014. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva: IPCC. https://www.ipcc.ch/report/ar5/syr/.

Irvine, William Braxton. 2009. *A Guide to the Good Life: The Ancient Art of Stoic Joy*. Oxford: Oxford University Press.

Jacobs, Arthur M., and Roel M. Willems. 2017. "The Fictive Brain: Neurocognitive Correlates of Engagement in Literature." *Review of General Psychology* (April 17): 14 pp. doi:10.1037/gpr0000106.

Jamail, Dahr. (2013) 2014. "Are We Falling Off the Climate Precipice? Scientists Consider Extinction." *The Huffington Post*. Updated February 16, 2014. http://www.huffingtonpost.com/dahr-jamail/climate-change-science_b_4459037.html.

Jensen, Derrick. 2006a. *Endgame*, Vol. 1, *The Problem of Civilization*. New York: Seven Stories.

_____. 2006b. *Endgame*, Vol. 2, *Resistance*. New York: Seven Stories.

_____. 2016. *The Myth of Human Supremacy*. New York: Seven Stories.

Johns-Putra, Adeline. 2016. "Climate Change in Literature and Literary Studies: From Cli-Fi, Climate Change Theatre and Ecopoetry to Ecocriticism and Climate Change Criticism." *Wiley Interdisciplinary Reviews: Climate Change* 7 (2): 266–82. doi:10.1002/wcc.385.

Keller, David P., Ellias Y. Feng, and Andreas Oschlies. 2014. "Potential Climate Engineering Effectiveness and Side Effects during a High Carbon Dioxide-Emission Scenario." *Nature Communications* 5:11 pp. doi:10.1038/ncomms4304.

Kleftaras, George, and Evangelia Psarra. 2012. "Meaning in Life, Psychological Well-Being and Depressive Symptomatology: A Comparative Study." *Psychology* 3 (4): 337–45. doi:10.4236/psych.2012.34048.

Kleidon, A., and M. Renner. 2013. "A Simple Explanation for the Sensitivity of the Hydrologic Cycle to Surface Temperature and Solar Radiation and its Implications for Global Climate Change." *Earth System Dynamics* 4 (2): 455–65. doi:10.5194/esd-4-455-2013.

Klein, Naomi. 2014. *This Changes Everything: Capitalism vs. the Climate*. London: Allen Lane.

Kluwick, Ursula. 2014. "Talking about Climate Change: The Ecological Crisis and Narrative Form." In *The Oxford Handbook of Ecocriticism*, edited by Greg Garrard, 502–16. Oxford: Oxford University Press.

Kolbert, Elizabeth. 2006. *Field Notes from a Catastrophe: Man, Nature, and Climate Change*. New York: Bloomsbury.

_____. 2014. *The Sixth Extinction: An Unnatural History*. New York: Henry Holt.

Lewis, Simon L., and Mark A. Maslin. 2015. "Defining the Anthropocene." *Nature* 519:171–80. doi:10.1038/nature14258.

Lynas, Mark. 2007. *Six Degrees: Our Future on a Hotter Planet*. London: Fourth Estate.

Malm, Andreas, and Alf Hornborg. 2014. "The Geology of Mankind? A Critique of the Anthropocene Narrative." *The Anthropocene Review* 1 (1): 62–69. doi:10.1177/2053019613516291.

Mann, Michael. 2013. "Climate-Change Deniers Must Stop Distorting the Evidence." Live Science (science news web page), September 26. http://www.livescience.com/39957-climate-change-deniers-must-stop-distorting-the-evidence.html.

Marshall, George. 2014. *Don't Even Think about It: Why Our Brains Are Wired to Ignore Climate Change*. New York: Bloomsbury.

Mathesius, Sabine, Matthias Hofmann, Ken Caldeira, and Hans Joachim Schellnhuber. 2015. "Long-Term Response of Oceans to CO_2 Removal from the Atmosphere." *Nature Climate Change* 5:1107–13. doi:10.1038/NCLIMATE2729.

Mayer, Frederick W. 2012. "Stories of Climate Change: Competing Narratives, the Media, and U.S. Public Opinion 2001–2010." Joan Shorenstein Center on the Press, Politics and Public Policy, Discussion Paper Series #D-72, February 2012. https://shorensteincenter.org/wp-content/uploads/2012/03/d72_mayer.pdf.

McAdams, Dan P. 2016. "From Actor to Agent to Author." In *Darwin's Bridge: Uniting the Humanities and Sciences*, edited Joseph Carroll, Dan P. McAdams, and Edward O. Wilson, 145–64. Oxford: Oxford University Press.

McMichael, Tony, Colin Butler, and Helen Louise Berry. 2014. "Climate Change and Health: IPCC Reports Emerging Risks, Emerging Consensus." The Conversation, March 30. https://theconversation.com/climate-change-and-health-ipcc-reports-emerging-risks-emerging-consensus-24213.

McPherson, Guy R. 2013. *Going Dark*. Baltimore: PublishAmerica.

_____. 2016. "Climate-Change Summary and Update." *Nature Bats Last* (blog). Updated August 2, 2016. https://guymcpherson.com/climate-chaos/climate-change-summary-and-update/.

_____. 2017. "Faster than Expected." The Weekly Hubris, June 1. http://weeklyhubris.com/faster-than-expected/.

Meehl, Gerald A., Warren M. Washington, William D. Collins, Julie M. Arblaster, Aixue Hu, Lawrence E. Buja, Warren G. Strand, and Haiyan Teng. 2005. "How Much More Global Warming and Sea Level Rise?" *Science* 307 (5716): 1769–72. doi:10.1126/science.1106663.

Met Office. 2016. "2017: Another Very Warm Year for Global Temperatures." Met Office (webpage), December 20. Accessed March 5, 2017. http://www.metoffice.gov.uk/news/releases/2016/global-forecast-2017.

Montero-Marin, Jesus, Marta Puebla-Guedea, Paola Herrera-Mercadal, Ausias Cebolla, Joaquim Soler, Marcelo Demarzo, Carmelo Vazquez, Fernando Rodríguez-Bornaetxea, and Javier García-Campayo. 2016. "Psychological Effects of a 1-Month Meditation Retreat on Experienced Meditators: The Role of Non-Attachment." *Frontiers in Psychology* 7:10 pp. doi:10.3389/fpsyg.2016.01935.

Moser, Susanne C., and Lisa Dilling. 2014. "Communicating Climate Change: Closing the Science-Action Gap." In *The Oxford Handbook of Climate Change and Society*, edited by John S. Dryzek, Richard B. Norgaard, and David Schlosberg, 161–74. Oxford: Oxford University Press.

Motesharrei, Safa, Jorge Rivas, and Eugenia Kalnay. 2014. "Human and Nature Dynamics (HANDY): Modeling Inequality and Use of Resources in the Collapse or Sustainability of Societies." *Ecological Economics* 101:90–102. doi:10.1016/j.ecolecon.2014.02.014.

Murphy, Patrick D. 2014. "Pessimism, Optimism, Human Inertia, and Anthropogenic Climate Change." *Interdisciplinary Studies in Literature and the Environment* 21 (1): 149–63. doi:10.1093/isle/isu027.

Nelissen, Rob M.A. 2017. "The Motivational Properties of Hope in Goal Striving." *Cognition and Emotion* 31 (2): 225–37. doi:10.1080/02699931.2015.1095165.

Nesse, Randolph N. 1999. "The Evolution of Hope and Despair." *Social Research* 66 (2): 429–69. http://www-personal.umich.edu/~nesse/Articles/EvolHopeDespair-JSocIssues-1999.PDF.

NOAA. 2017. "Recent Monthly Average at Mauna Loa CO_2." NOAA: Earth System Research Laboratory, Global Monitoring Division (webpage). Accessed June 6, 2017. https://esrl.noaa.gov/gmd/ccgg/trends/.

Oatley, Keith. 2011. *Such Stuff as Dreams: The Psychology of Fiction*. Chichester: Wiley-Blackwell.

Oreskes, Naomi, and Erik M. Conway. 2010. *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*. New York: Bloomsbury.

Örn Sigurðsson, Magnús. 2014. "The 'We can solve it' Narrative: The Misrepresentation of Climate Change within Contemporary Western Discourse." MA Thesis, University of Iceland. http://hdl.handle.net/1946/17781.

Palmer, Brian. 2015. "One Million, Two Million, Three Million Years Ago ..." onEarth, May 8. https://www.nrdc.org/onearth/one-million-two-million-three-million-years-ago.

Payne, Jonathan L., Andrew M. Bush, Noel A. Heim, Matthew L. Knope, and Douglas J. McCauley. 2016. "Ecological Selectivity of the Emerging Mass Extinction in the Oceans." *Science* 353 (6305): 1284–86. doi:10.1126/science.aaf2416.

Pearce, Fred. 2007. *With Speed and Violence: Why Scientists Fear Tipping Points in Climate Change*. Boston: Beacon.

Pimm, S. L., C. N. Jenkins, R. Abell, T. M. Brooks, J. L. Gittleman, L. N. Joppa, P. H. Raven, C. M. Roberts, and J. O. Sexton. 2014. "The Biodiversity of Species and Their Rates of Extinction, Distribution, and Protection." *Science* 344 (6187): 10 pp. doi:10.1126/science.1246752.

Pinker, Steven. 1997. *How the Mind Works*. New York: Norton.

Pittock, A. Barrie. (2005) 2009. *Climate Change: The Science, Impacts and Solutions*. 2nd revised edition. New York: Earthscan.

Poul, Alan (director). 2014. "Main Justice." *The Newsroom*, episode 22, story by Jon Lovett and Aaron Sorkin. Original air date November 23. HBO. http://www.hbo.com/the-newsroom/episodes/3/22-episode/index.html.

Rahmstorf, Stefan. 2013. "The New IPCC Climate Report." *RealClimate: Climate Science from Climate Scientists* (blog), September 27. http://www.realclimate.org/index.php/archives/2013/09/the-new-ipcc-climate-report/.

Revkin, Andrew. 2015. "National Geographic Explores Bill Nye's Climate Change Denial—and Arnold Schwarzenegger's Analysis." *New York Times*, October 31. https://dotearth.blogs.nytimes.com/2015/10/31/now-its-bill-nye-with-climate-change-denial-and-arnold-schwarzenegger-to-the-rescue/?_r=1.

Richardson, John H. 2015. "Ballad of the Sad Climatologist: When the End of Human Civilization Is Your Day Job." *Esquire*, August, 82–89. http://www.esquire.com/news-politics/a36228/ballad-of-the-sad-climatologists-0815/.

Ricke, Katharine L., and Ken Caldeira. 2014. "Maximum Warming Occurs about One Decade after a Carbon Dioxide Emission." *Environmental Research Letters* 9 (12): 8 pp. doi:10.1088/1748-9326/9/12/124002.

Rogelj, Joeri, Michael den Elzen, Niklas Höhne, Taryn Fransen, Hanna Fekete, Harald Winkler, Roberto Schaeffer, Fu Sha, Keywan Riahi, and Malte Meinshausen. 2016. "Paris Agreement Climate Proposals Need a Boost to Keep Warming Well Below 2°C." *Nature* 534:631–39. doi:10.1038/nature18307.

Romm, Joe. 2012. "IPCC's Planned Obsolescence: Fifth Assessment Report Will Ignore Crucial Permafrost Carbon Feedback!" ThinkProgress, December 2. https://thinkprogress.org/ipccs-planned-obsolescence-fifth-assessment-report-will-ignore-crucial-permafrost-carbon-feedback-5d2289e9461d#.4ma5pfth3.

Sagan, Carl. 1980. *Cosmos*. New York: Random House.

Scalise Sugiyama, Michelle. 2001. "Narrative Theory and Function: Why Evolution Matters." *Philosophy and Literature* 25 (2): 233–50. doi:10.1353/phl.2001.0035.

Schäfer, Mike S., and Inga Schlichting. 2014. "Media Representations of Climate Change: A Meta-Analysis of the Research Field." *Environmental Communication* 8 (2): 142–60. doi:10.1080/17524032.2014.914050.

Schlenker, Wolfram, and Michael J. Roberts. 2009. "Nonlinear Temperature Effects Indicate Severe Damages to U.S. Crop Yields under Climate Change." *PNAS* 106 (37): 15594–98. doi:10.1073/pnas.0906865106.

Schmidtko, Sunke, Lothar Stramma, and Martin Visbeck. 2017. "Decline in Global Oceanic Oxygen Content during the Past Five Decades." *Nature* 542:335–39. doi:10.1038/nature21399.

Schuur, E. A. G., A. D. McGuire, C. Schädel, G. Grosse, J. W. Harden, D. J. Hayes, G. Hugelius, C. D. Koven, P. Kuhry, D. M. Lawrence, S. M. Natali, D. Olefeldt, V. E. Romanovsky, K. Schaefer, M. R. Turetsky, C. C. Treat, and J. E. Vonk. 2015. "Climate Change and the Permafrost Carbon Feedback." *Nature* 520:171–79. doi:10.1038/nature14338.

Sekerci, Yadigar, and Sergei Petrovskii. 2015. "Mathematical Modelling of Plankton–Oxygen Dynamics under the Climate Change." *Bulletin of Mathematical Biology* 77 (12): 2325–53. doi:10.1007/s11538-015-0126-0.

Shakova, Natalia, Igor Semiletov, Anatoly Salyuk, Vladimir Yusupov, Denis Kosmach, and Örjan Gustafsson. 2010. "Extensive Methane Venting to the Atmosphere from Sediments of the East Siberian Arctic Shelf." *Science* 327 (5970): 1246–50. doi:10.1126/science.1182221.

Sharot, Tali. 2011. "The Optimism Bias." *Current Biology* 21 (23): R941–R945. doi:10.1016/j.cub.2011.10.030.

Shtulman, Andrew. 2017. *Scienceblind*: *Why Our Intuitive Theories About the World Are So Often Wrong.* New York: Basic Books.

Smil, Vaclav. 2013. *Harvesting the Biosphere: What We Have Taken from Nature*. Cambridge, MA: MIT Press.

Smith, Philip, and Nicolas Howe. 2015. *Climate Change as Social Drama: Global Warming in the Public Sphere*. New York: Cambridge University Press.

Smith, Steven J., James Edmonds, Corinne A. Hartin, Anupriya Mundra, and Katherine Calvin. 2015. "Near-Term Acceleration in the Rate of Temperature Change." *Nature Climate Change* 5:333–36. doi:10.1038/nclimate2552.

Snyder, C. R. 2002. "Hope Theory: Rainbows in the Mind." *Psychological Inquiry* 13 (4): 249–75. doi:10.1207/S15327965PLI1304_01.

Steffen, Will, Wendy Broadgate, Lisa Deutsch, Owen Gaffney, and Cornelia Ludwig. 2015. "The Trajectory of the Anthropocene: The Great Acceleration." *The Anthropocene Review* 2 (1): 81–98. doi:10.1177/2053019614564785.

Steffen, Will, Jacques Grinevald, Paul Crutzen, and John McNeill. 2011. "The Anthropocene: Conceptual and Historical Perspectives." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 369 (1938): 842–67. doi:10.1098/rsta.2010.0327.

Steger, Michael F., Shigehiro Oishi, and Todd B. Kashdan. 2009. "Meaning in Life across the Life Span: Levels and Correlates of Meaning in Life from Emerging Adulthood to Older Adulthood." *The Journal of Positive Psychology* 4 (1): 43–52. doi:10.1080/17439760802303127.

Stoknes, Per Espen. 2015. *What We Think about When We Try Not to Think about Climate Change: Toward a New Psychology of Climate Change*. White River Junction, VT: Chelsea Green.

Storelvmo, T., T. Leirvik, U. Lohmann, P. C. B. Phillips, and M. Wild. 2016. "Disentangling Greenhouse Warming and Aerosol Cooling to Reveal Earth's Climate Sensitivity." *Nature Geoscience* 9:286–89. doi:10.1038/ngeo2670.

Thomas, Madeleine. 2014. "Climate Depression Is for Real: Just Ask a Scientist." Grist, October 28. http://grist.org/climate-energy/climate-depression-is-for-real-just-ask-a-scientist/.

Tickell, Oliver. 2008. "On a Planet 4C hotter, All We Can Prepare for Is Extinction." *The Guardian*, August 11. https://www.theguardian.com/commentisfree/2008/aug/11/climatechange.

Tooby, John, and Leda Cosmides. 2001. "Does Beauty Build Adapted Minds? Toward an Evolutionary Theory of Aesthetics, Fiction and the Arts." *SubStance* 30 (1and2): 6–27. doi:10.1353/sub.2001.0017.

Trexler, Adam. 2015. *Anthropocene Fictions: The Novel in a Time of Climate Change*. Charlottesville: University of Virginia Press.

Wadhams, Peter. 2016. *A Farewell to Ice: A Report from the Arctic*. London: Allen Lane.

Ward, Peter. 2009. *The Medea Hypothesis: Is Life on Earth Ultimately Self-Destructive?* Princeton, NJ: Princeton University Press.

Weart, Spencer R. (2003) 2008. *The Discovery of Global Warming*. Revised and expanded edition. Cambridge, MA: Harvard University Press.

Wiener, Jon. 2014. "We're the Asteroid: Elizabeth Kolbert on Species Extinction and Climate Change." *The Nation*, April 22. https://www.thenation.com/article/were-asteroid-elizabeth-kolbert-species-extinction-and-climate-change/.

Wilson, Edward O. 1998. *Consilience: The Unity of Knowledge*. London: Abacus.

_____. 2016. *Half-Earth: Our Planet's Fight for Life*. New York: Liveright.

Wilson, John R. U., Pablo García-Díaz, Phillip Cassey, David M. Richardson, Petr Pyšek, and Tim M. Blackburn. 2016. "Biological Invasions and Natural Colonisations Are Different—The Need for Invasion Science." *NeoBiota* 31:87–98. doi:10.3897/neobiota.31.9185.

Wolpert, Lewis. 1992. *The Unnatural Nature of Science*. Cambridge, MA: Harvard University Press.

worldometers. 2017. "Current World Population." worldometers (webpage). Accessed March 5, 2017. http://www.worldometers.info/world-population/.

WWF. 2015. *Living Blue Planet Report: Species, Habitats, and Human Well-Being*. Gland, Switzerland: WWF International. http://assets.worldwildlife.org/publications/817/files/original/Living_Blue_Planet_Report_2015_Final_LR.pdf?1442242821and_ga=1.199105196.261004227.1487687026.

Zeebe, Richard E., Andy Ridgwell, and James C. Zachos. 2016. "Anthropogenic Carbon Release Rate Unprecedented during the Past 66 Million Years." *Nature Geoscience* 9:325–29. doi:10.1038/NGEO2681.

Zhang, Hua, Shuyun Zhao, Zhili Wang, Xiaoye Zhang, and Lianchun Song. 2016. "The Updated Effective Radiative Forcing of Major Anthropogenic Aerosols and Their Effects on Global Climate at Present and in the Future." *International Journal of Climatology* 36 (12): 4029–44. doi:10.1002/joc.4613.

Zickfield, Kirsten, and Tyler Herrington. 2015. "The Time Lag between a Carbon Dioxide Emission and Maximum Warming Increases with the Size of the Emission." *Environmental Research Letters* 10 (3): 3 pp. doi:10.1088/1748-9326/10/3/031001.