

# THE SHORT-TERM TEMPTATIONS AND LONG-TERM RISKS OF ENVIRONMENTAL CATASTROPHISM

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**ABSTRACT:** Framing environmental problems as catastrophic likely undercuts public support for sound environmental policies over time. This article reviews three historic examples of influential books predicting environmental catastrophes. Although the authors brought public attention to real and important problems, the embellished claims that failed to materialize undermined future warnings of environmental problems. We consider the effects of exaggeration on the discourse surrounding global warming, the most serious environmental issue ever faced by modern society. We further consider the incentives for scientists and others to exaggerate impacts to motivate complacent citizens and policymakers. Ultimately, however, exaggerating climate change doomsday will undermine public support for climate change policies if extreme predictions do not materialize.

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The human psyche seems particularly prone to catastrophic and apocalyptic scenarios.<sup>1</sup> Nowhere is this tendency more pronounced than with environmental risks, such as environmental destruction, toxic poisoning of nature and the human body, natural resource depletion, population explosion, and most recently, global warming.<sup>2</sup> These are all serious and real problems that should, and need, to be seriously addressed, as they threaten long-term degradation of human existence and our natural environment. And these problems seem even more ominous if the public and policymakers are not taking action as seriously or as fast as many think warranted.

Environmental activists, the media, policymakers, and even some scientists<sup>3</sup> are therefore tempted to paint doomsday scenarios of our environmental

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1. See generally PASCAL BRUCKNER, *THE FANATICISM OF THE APOCALYPSE: SAVE THE EARTH, PUNISH HUMAN BEINGS* (Steven Rendall, trans., Polity Press 2013) (2011).

2. See generally FREDERICK BUELL, *FROM APOCALYPSE TO WAY OF LIFE: ENVIRONMENTAL CRISIS IN THE AMERICAN CENTURY* (2003); M. Jimmie Killingsworth & Jacqueline S. Palmer, *Millennial Ecology: The Apocalyptic Narrative from Silent Spring to Global Warming*, in *GREEN CULTURE: ENVIRONMENTAL RHETORIC IN CONTEMPORARY AMERICA* 21, 21–45 (Carl G. Herndl & Stuart C. Brown eds., 1996).

3. Examples of such scientists are the scientific authors of the three books summarized in Part I, *infra*. See generally RACHEL CARSON, *SILENT SPRING* (Penguin Classics 2012) (1962); PAUL R.

future, through some mix of genuine concern about the long-term consequences of underaddressed environmental problems, combined with a perception that catastrophic warnings are needed to stimulate the public and policymakers to take urgent action. Doomsday scenarios may indeed catalyze public and policy action in the short term, but carry a “boy who cried wolf” risk over the long term if some of the projected disasters do not come true.

In this article, we argue that such a dynamic has impeded long-term success in addressing persistent environmental problems over the past half century, and is in danger of undermining long-term public commitment and policymaker determination to address the most challenging environmental problem of the twenty-first century, global climate change.<sup>4</sup> We begin by considering three key books warning of environmental catastrophes published in the 1960s and 1970s that were influential in their time.<sup>5</sup> We explain the real problems that they addressed, the exaggerated claims that they made, and the consequences of those exaggerations. One emerges with a sense that this strain of literature had a beneficial impact in helping to spur efforts to craft legal solutions to address environmental problems, at least in the short term. Indeed, to an unknowable degree, the action these books spurred may have been their undoing, prompting action to solve the problems they predicted. Yet the books relied upon exaggerated claims and unfulfilled predictions that undermine the credibility of the work, and the concerns they flagged, in the long term. The unrealized predictions undermined the credibility of the scientists who wrote the books, and fueled public distrust of science and data in assessing environmental threats. Moreover, unforeseen consequences from action taken in response to the books have been used to criticize government action to address environmental problems.<sup>6</sup>

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EHRlich, *THE POPULATION BOMB* (1968); DONELLA H. MEADOWS ET AL., *THE LIMITS TO GROWTH* (5th prtng. 1972) [hereinafter *LIMITS TO GROWTH*].

4. Although all three books were authored and published in the United States, they did address global issues and had a political impact outside the United States. See generally CARSON, *supra* note 3; EHRlich, *supra* note 3; MEADOWS ET AL., *supra* note 3; David Lam, *How the World Survived the Population Bomb: Lessons from 50 Years of Extraordinary Demographic History*, 48 *DEMOGRAPHY* 1231 (2011); Graham Turner, *A Comparison of the Limits to Growth with Thirty Years of Reality*, 18 *GLOBAL ENVTL. CHANGE* 397 (2008); Eliza Griswold, *How “Silent Spring” Ignited the Environmental Movement*, N.Y. TIMES MAG. (Sept. 21, 2012), [http://www.nytimes.com/2012/09/23/magazine/how-silent-spring-ignited-the-environmental-movement.html?\\_r=0](http://www.nytimes.com/2012/09/23/magazine/how-silent-spring-ignited-the-environmental-movement.html?_r=0). For purposes of our analysis, however, we will focus on the impacts of these three books on the political dynamics of perceived environmental crisis in the United States.

5. See *infra* Part I.

6. Skepticism of scientific consensus extends beyond climate, ranging from the safety of adding fluoride to drinking water to whether vaccinating children causes autism. The scientific community is aware of this problem, referring to public distrust of scientific data as the “science communication problem.” Legal scholars and commentators, too, should consider how this trend affects the willingness of the public to accept law and policy changes in the light of uncertain information. Joel Achenbach, *Why Do Many Reasonable People Doubt Science?*, NAT’L GEOGRAPHIC (Mar. 2015), <http://ngm.nationalgeographic.com/2015/03/science-doubters/achenbach-text> (“Empowered by their own sources of information and their own interpretations of research, doubters have declared war on the consensus of experts.”); William D. Nordhaus, *Why the Global Warming Skeptics Are Wrong*, N.Y. REV. BOOKS (Mar. 22, 2012), <http://www.nybooks.com/articles/2012/03/22/why-global-warming-skeptics-are-wrong/> (“One might argue that there are many uncertainties

We then turn to the present and future, and consider the lessons from the use of catastrophic rhetoric in the 1960s and 1970s for today's environmental challenges, in particular climate change.<sup>7</sup> Once again, we face a situation, at least in the United States, where both the public and policymakers do not seem to have appropriate urgency and willingness to take action to battle climate change. There is thus a temptation to present the most dire and extreme predictions, especially those that seem most immediate and near term, many of which are possible but unlikely. This may again help stimulate useful action in the short term (although arguably could instead instill hopelessness and apathy), but may result in catastrophic predictions that end up being empirically disproven, similar to many of the most scary predictions in the 1960s and 1970s. As we have seen from that earlier era, these false predictions of doom may backfire and undercut public and policymaker commitment to address the environmental problem, which may still be of great importance even if not as catastrophic as some originally warned. We conclude by emphasizing the need to resist oversensationalizing environmental risks, while still promoting serious debate and action on pressing environmental problems.<sup>8</sup>

### I. HISTORICAL EXAMPLES

In the 1960s and 1970s, three books—*Silent Spring*, *The Population Bomb*, and *Limits to Growth*—generated widespread public concern about real and important environmental problems, including the use of pesticides, rapidly growing population, and depletion of natural resources.<sup>9</sup> These books relied heavily on catastrophic predictions of doomsday scenarios to capture public attention. It worked. Many credit *Silent Spring* as prompting the environmental movement in the United States;<sup>10</sup> the other works fueled the growth of that movement by increasing public concern about human effects on the natural environment. The environmental movement produced a slew of Congressional action in the form of laws designed to protect the natural environment and human health. Indeed, the majority of federal environmental statutes in place in the United States today were enacted in the 1970s and 1980s in direct response to public concerns about the looming catastrophe of environmental disaster prompted in large part by these three books.

Unfortunately, these books have another, less frequently explored legacy: the very catastrophic environmentalism that captured public attention has diminished public willingness to take seriously subsequent environmental concerns. The books' exaggerated and embellished claims also undermined the long-term credibility of scientists who are attempting to alert the public to other

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here, and we should wait until the uncertainties are resolved. Yes, there are many uncertainties. That does not imply that action should be delayed.”)

7. See discussion *infra* Section I.D.

8. See discussion *infra* p. 366.

9. See, e.g., Killingsworth & Palmer, *supra* note 2, at 27–35.

10. See, e.g., THEO COLBORN ET AL., OUR STOLEN FUTURE 167 (1996); Eliza Griswold, *How “Silent Spring” Ignited the Environmental Movement*, N.Y. TIMES MAG. (Sept. 21, 2012), [http://www.nytimes.com/2012/09/23/magazine/how-silent-spring-ignited-the-environmental-movement.html?\\_r=0](http://www.nytimes.com/2012/09/23/magazine/how-silent-spring-ignited-the-environmental-movement.html?_r=0).

environmental concerns.<sup>11</sup> Exploring these books and their effects provides a foundation for considering, in Part III, how the history of predictions of environmental doom have affected, and may affect going forward, public and political plight of climate change action.

### A. Rachel Carson, *Silent Spring*

Rachel Carson's 1962 book *Silent Spring* explored the harmful effects of pesticides on the natural environment and human health.<sup>12</sup> Carson argued that the effects of pesticides went beyond the targeted pest, harming both natural ecosystems and human health.<sup>13</sup> She focused primarily on the pesticide dichlorodiphenyltrichloroethane (DDT), but also explored other synthetic pesticides. Carson suggested that the use of pesticides would allow invasive species to spread, and doing so would produce species that become resistance to pesticides over time. The widespread use of pesticides, she argued, would cause illness in humans and forever alter natural ecosystems while imperiling the species within them. Carson prescribed that "[p]ractical advice should be '[s]pray as little as you possibly can' rather than '[s]pray to the limit of your capacity.'"<sup>14</sup> The reaction to this prescription was astounding.

The book, which took Carson four years to write, was serialized in the *New Yorker*. The book reached mainstream America when it became a Book-of-the-Month Club selection and the subject of a CBS Reports television news program.<sup>15</sup> Carson testified before the Senate subcommittee on pesticides in 1963 and appeared on *The Tonight Show* as part of a well-orchestrated campaign to get maximum media coverage for her cause.<sup>16</sup> The domestic chemical industry

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11. See, e.g., BJØRN LOMBERG, *THE SKEPTICAL ENVIRONMENTALIST: MEASURING THE REAL STATE OF THE WORLD 2* (Hugh Matthews trans., Cambridge University Press 2001) (arguing that the world is generally getting better and that this is evidence that we should not take action to prevent environmental doomsday); Ronald Bailey, *Everyone Loves a Good Apocalypse: Even as the World Gets Better and Better, People Continue to Stubbornly Believe the End Is Nigh*, REASON, Nov. 2015, at 16, 17 ("Maybe . . . it's exciting to think that your generation is the last. Your generation just happens to be living at the hinge point of history."); Gregg Easterbrook, *Everything You Know About the Environment Is Wrong: A Liberal Skeptic's Guide to Earth Day*, NEW REPUBLIC, Apr. 30, 1990, at 14 (questioning popular environmental concerns with critiques that they are inaccurate); Doug Edmeades, *The End Is Nigh! No, Not Quite Yet*, STUFF (May 4, 2015, 6:30 PM), <http://www.stuff.co.nz/business/farming/opinion/68103122/the-end-is-nigh-no-not-quite-yet> (using previously unfulfilled predictions about environmental disasters to advocate for intensive agriculture).

12. CARSON, *supra* note 3.

13. CARSON, *supra* note 3, at 202 ("A quarter century ago cancer in children was considered a medical rarity. Today, more American school children die of cancer than from any other disease."). But see generally Ronald Bailey, *The End of Doom: Good News! Dire Predictions About Cancer Epidemics, Mass Extinction, Overpopulation, and More Turned Out to Be a Bust*, REASON, Oct. 2015, at 20. Bailey argues that Carson failed to mention that the number of children dying from diseases other than cancer was dramatically falling, and that survival rates of children with cancer were improving. *Id.* This led Bailey to note: "So did the predicted cancer doom ever arrive? No. Remember—overall incidence rates are down." *Id.* at 22.

14. CARSON, *supra* note 3, at 253 (quoting Dutch biologist C.J. Briejèr).

15. Griswold, *supra* note 10.

16. See *id.*; Douglas Kysar, *The Consultants' Republic*, 121 HARV. L. REV. 2041, 2042 (2008) (reviewing TED NORDHAUS & MICHAEL SHELLENBERGER, *BREAK THROUGH: FROM THE DEATH OF ENVIRONMENTALISM TO THE POLITICS OF POSSIBILITY* (2007)).

launched a robust and well-funded counterattack to her claims, but Carson's meticulous research and widespread support among scientists allowed her work to largely withstand its contemporary critics.<sup>17</sup>

*Silent Spring* is widely credited with creating the environmental movement in the United States.<sup>18</sup> President Nixon created the Environmental Protection Agency in part to mitigate the concerns raised by Carson about the United States Department of Agriculture's (USDA) regulation of pesticides. In 1972, the United States banned domestic sale of DDT except for public health uses.<sup>19</sup> According to the most recent available study, as of 2009, most countries in the world had stopped producing the pesticide.<sup>20</sup> Public concern over pesticide use ended the widespread use of drenching fields with DDT. This was, by all accounts, a real problem—and one that legal action largely solved with regard to DDT.

From a modern perspective, however, some of the outcomes of Carson's work were less successful. Carson's broader claims with regard to pesticide use have largely been seen as exaggerated: in particular, claims of chemicals destroying nature and entire ecosystems and the desire to ban bad actors outright.<sup>21</sup> Some argue that the DDT restrictions resulting from Carson's work have hampered agriculture and increased incidence of malaria.<sup>22</sup> Opponents to her work suggest that the complete chemical bans resulted in global bans on DDT, resulting in a tremendous increase in malaria deaths among African children.<sup>23</sup> Moreover, Carson's work is now subject to widespread scientific critiques of overly simplistic antichemical exaggerations.<sup>24</sup>

Carson, alas, was unable to respond to these criticisms; she died of cancer within years of her book being released.<sup>25</sup> Despite this unfortunate and premature ending, Carson produced a legacy of incalculable proportions in prompting concerns about both unrestrained pesticide use and awareness of environmental

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17. See generally Bailey, *supra* note 13.

18. See Griswold, *supra* note 10. We outline Carson's influence at two levels of generality. First, we discuss the effects of Carson's work with regard to pesticides specifically in Section I.A. Then, we situate her contribution—and presumed exaggerations—in the context of the environmental movement of the 1960s more generally in Section I.D.

19. *Id.*

20. *Id.*; Three countries in the world currently produce DDT: India, China, and the Democratic People's Republic of Korea (North Korea). Henk van den Berg, *Global Status of DDT and Its Alternatives for Use in Vector Control to Prevent Disease*, 117 ENVTL. HEALTH PERSP. 1656, 1657 (2009).

21. Gary E. Marchant, *Risk Over-Simplified: The Enduring and Unfortunate Legacy of Silent Spring*, in *SILENT SPRING AT 50: THE FALSE CRISES OF RACHEL CARSON* 271–88 (Roger Meiners et al. eds., 2012).

22. William Souder, *Rachel Carson Didn't Kill Millions of Africans: How the 50-Year-Old Campaign Against Silent Spring Still Distorts Environmental Debates*, SLATE (Sept. 4, 2012, 5:02 AM), [http://www.slate.com/articles/health\\_and\\_science/science/2012/09/silent\\_spring\\_turns\\_50\\_biographer\\_william\\_souder\\_clears\\_up\\_myths\\_about\\_rachel\\_carson\\_.html](http://www.slate.com/articles/health_and_science/science/2012/09/silent_spring_turns_50_biographer_william_souder_clears_up_myths_about_rachel_carson_.html) (defending Carson against claims that she “is responsible for the devastations of malaria” advanced by the American Enterprise Institute and Competitive Enterprise Institute, along with author Michael Crichton).

23. Griswold, *supra* note 10 (noting inflammatory statements blaming Carson for the effects of malaria).

24. See Marchant, *supra* note 21.

25. Griswold, *supra* note 10.

concerns more broadly. Her critics' vilification of Carson and her work provided an early forerunner to future criticisms of scientists ringing alarm bells for environmental ills.<sup>26</sup>

### B. Paul Ehrlich, *The Population Bomb*

In 1968, Stanford professor Paul Ehrlich published *The Population Bomb*, which was cowritten by his then uncredited wife, Anne Ehrlich.<sup>27</sup> *The Population Bomb* warned that human overpopulation would produce widespread starvation: "The birth rate must be brought into balance with the death rate or mankind will breed itself into oblivion. . . [p]opulation control is the only answer."<sup>28</sup> Ehrlich also outlined the detrimental effects of population growth on the natural environment, including extinction of animal species,<sup>29</sup> irresponsible use of natural resources,<sup>30</sup> use of synthetic pesticides,<sup>31</sup> poor air quality,<sup>32</sup> and degraded human connection with the natural environment.<sup>33</sup> The book also made a number of specific predictions of catastrophic effects of population growth. For example, the prologue predicted that "[i]n the 1970s the world will undergo famines—hundreds of millions of people are going to starve to death."<sup>34</sup> Although *The Population Bomb* captured public attention, it did so by making radical claims that ultimately did not come to fruition.<sup>35</sup>

For a moment in the 1970s, it appeared that Ehrlich's predictions were coming true. Increased oil prices and bad harvests in the Soviet Union caused food prices to skyrocket.<sup>36</sup> In the Sahel of West Africa, it is believed that drought caused deaths from starvation of more than 100,000 people in 1977.<sup>37</sup>

Ultimately, though, the forecasts of doom in *The Population Bomb* largely failed to materialize. The book that created an international conversation, selling millions of copies,<sup>38</sup> made a series of predictions that largely failed to come to

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26. See *infra* Sections I.B and I.C.

27. Paul R. Ehrlich & Anne H. Ehrlich, *The Population Bomb Revisited*, ELECTRONIC J. SUSTAINABLE DEV., Summer 2009, at 5, 5 ("Although the publisher insisted on a single author, it was from the beginning a joint effort.")

28. PAUL R. EHRLICH, *THE POPULATION BOMB*, at xi (1968).

29. *Id.* at 46 (attributing extinction of the passenger pigeon to the direct and indirect effects of population growth).

30. *Id.* at 47–48.

31. *Id.* at 53–56.

32. *Id.* at 57–58.

33. *Id.* at 63–65.

34. *Id.* at xi.

35. John Tierney, *Betting on the Planet*, N.Y. TIMES, Dec. 2, 1990, at SM52 (more than 3 million copies of *The Population Bomb* were sold).

36. Oliver de Schutter, *Don't Let Food Be the Problem*, FOREIGN POL'Y, July–Aug. 2015, at 68, 68.

37. Peter Gwynne, *Lethal Spread of the Sands*, NEWSWEEK, Sept. 19, 1977, at 80, 80. *But see* Julian L. Simon, *Resources Population, Environment: An Oversupply of False Bad News*, 208 SCIENCE 1431, 1431 (1980) (calling into question the accuracy of this figure based upon the supporting information).

38. Ehrlich & Ehrlich, *supra* note 27; Tierney, *supra* note 35; *see also* David Lam, *How the World Survived the Population Bomb: Lessons from 50 Years of Extraordinary Demographic History*, 48 DEMOGRAPHY 1231, 1233 (2011) (noting that *The Population Bomb* was but one

fruition.<sup>39</sup> The Ehrlichs, who generally stand behind their work,<sup>40</sup> acknowledge that “the famines were smaller than our reading . . . at the time had led us to anticipate” and that it was “wrong.”<sup>41</sup>

The use of hyperbole, both in the title and the doomsday predictions, have caused some commentators to draw comparisons between Paul Ehrlich and Thomas Malthus, the English cleric who predicted, in 1798, that population growth would outstrip food production.<sup>42</sup> As one commentator noted, “Everyone now agrees that Malthus was wrong.”<sup>43</sup> Malthus, like Ehrlich, failed to predict humanity’s ability to innovate to increase food production and control population growth.<sup>44</sup> Ehrlich’s dogged support of his original predictions, even as they failed to realize, made him the subject of criticism within the United States.<sup>45</sup> How was Ehrlich so far off the mark?

Partially in response to the food scares of the 1970s, many governments around the globe produced more food through intensifying agriculture—producing more food to feed more people, using roughly relatively little additional land.<sup>46</sup> Although food poverty statistics are notoriously difficult to gather and accurately report,<sup>47</sup> it is clear that the predictions of mass famine were generally incorrect.

Similarly, *The Population Bomb* predicted that the birthrate would increase, when in fact it dropped.<sup>48</sup> Although the world population has grown from 3.5 billion at the time *The Population Bomb* was published to 6.7 billion,<sup>49</sup> birthrates have dropped, and are expected to continue to decline.<sup>50</sup> The Ehrlichs also acknowledge that their predictions are generally recognized as a failure, stating

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book—although admittedly the best known—in a broad context of academic and media concern about population growth in the 1960s).

39. Tierney, *supra* note 35.

40. Ehrlich & Ehrlich, *supra* note 27, at 11 (“We think, with all its warts, *The Bomb* did exactly what we had hoped . . . [i]t was . . . a successful tract, and we’re proud of it.”).

41. *Id.* at 9.

42. Bill McKibben, *Reaching the Limit*, N.Y. REV. BOOKS, May 29, 1997, at 32, 33 (reviewing JOEL E. COHEN, *HOW MANY PEOPLE CAN THE EARTH SUPPORT?* (1996) and CARRYING CAPACITY NETWORK, *THE CARRYING CAPACITY BRIEFING BOOK* (1996)).

43. *Id.*

44. *Id.*

45. Dwight R. Lee, *The Perpetual Assault on Progress*, SOCIETY, Mar.–Apr. 1992, at 50, 55 (noting that Ehrlich revised his predictions of doom to occur first in the 1970s, then 1985, then 1999).

46. WORLD RESOURCES REPORT, *CREATING A SUSTAINABLE FOOD FUTURE: A MENU OF SOLUTIONS TO SUSTAINABLY FEED MORE THAN 9 BILLION PEOPLE BY 2050*, at 59–60 (2013). The report notes that the constant growth rate of agricultural production since 1960 is attributable to improvements in technology or better use of technology, rather than the role of inputs and land, including in the spread of advanced farming techniques to China, Brazil, and Argentina. *Id.*

47. See generally Simon, *supra* note 37 (debunking a number of food poverty statistics and suggesting that bad news is prompted by funding incentives, sales, and psychological propensities to overestimate future harms, and the desire to mobilize institutions to make things better).

48. Ehrlich & Ehrlich, *supra* note 27, at 7; Jeff Wise, *About That Overpopulation Problem*, SLATE (Jan. 9, 2013, 7:45 AM), [http://www.slate.com/articles/technology/future\\_tense/2013/01/world\\_population\\_may\\_actually\\_start\\_declining\\_not\\_exploding.html](http://www.slate.com/articles/technology/future_tense/2013/01/world_population_may_actually_start_declining_not_exploding.html).

49. Ehrlich & Ehrlich, *supra* note 27, at 7.

50. McKibben, *supra* note 42, at 32 (noting that falling fertility rates have caused computer models to suggest that the planet’s population will stabilize at approximately 11 billion people);

“[i]n honesty, the scenarios were way off” particularly with regard to timing.<sup>51</sup> They have suggested that population may have slowed as a result of their book,<sup>52</sup> an untestable assertion. They also acknowledge that the women’s rights movement, an unforeseen social revolution, lowered the birthrate.<sup>53</sup>

Technological and social change wrought by humans forestalled the disasters Ehrlich predicted with regard to both food production and birthrates. This is not to say, however, that the concerns underlying his predictions were unfounded. Despite the inaccuracy of Ehrlich’s predictions, humanity has not escaped the broader concerns he raised. About twelve percent of the world’s population is presently undernourished, with 795 million people having insufficient food to lead a healthy active life.<sup>54</sup> Scientists also continue to predict that the human population continues to brush up against the edge of the earth’s carrying capacity—the ability to support human life without degrading the environment.<sup>55</sup>

Interestingly, the Ehrlichs maintain that the biggest flaw in their work was “that it was much too optimistic about the future.”<sup>56</sup> The larger, more nuanced arguments in their work about the trade-offs between environmental quality and human population size persist.<sup>57</sup> These arguments may be, however, undermined because of the discredited predictions—notwithstanding the merit of the more general claims. More broadly, the credibility of scientists in predicting catastrophic effects of human action on the environment likely suffer as a result of failed predictions.<sup>58</sup>

### C. Club of Rome, *The Limits to Growth*

In 1972, the Club of Rome, an international group comprised of intellectuals and civil servants,<sup>59</sup> commissioned *The Limits to Growth*, a book with four coauthors from Massachusetts Institute of Technology who used computers to simulate the consequences of humans on the environment, in a modeling program called World3.<sup>60</sup> The authors operated from the premise that growth trends along dimensions such as population, industrialization, and other indices would

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Indur M. Goklany, *Have Increases in Population, Affluence, and Technology Worsened Human and Environmental Well-Being?*, ELECTRONIC J. SUSTAINABLE DEV., Summer 2009, at 3, 3 (“[G]lobal population is no longer growing exponentially.”); Wise, *supra* note 48.

51. Ehrlich & Ehrlich, *supra* note 27, at 9.

52. *Id.*

53. *Id.* (noting the importance of contraception and abortion in reducing birthrates).

54. Schutter, *supra* note 36, at 69.

55. See generally CARRYING CAPACITY NETWORK, THE CARRYING CAPACITY BRIEFING BOOK (1996) (2 vols.).

56. Ehrlich & Ehrlich, *supra* note 27, at 8.

57. See generally JOEL E. COHEN, HOW MANY PEOPLE CAN THE EARTH SUPPORT (1995).

58. See *infra* Part II.

59. The Club of Rome is described as “an informal, international group of distinguished businessmen, statesmen, and scientists.” DONELLA H. MEADOWS ET AL., LIMITS TO GROWTH: THE 30-YEAR UPDATE, at ix (2004) [hereinafter 30-YEAR UPDATE]. Its membership was “approximately seventy persons of twenty-five nationalities” united by “their overriding conviction that the major problems facing mankind are of such complexity and so interrelated that traditional institutions and policies are no longer able to cope with them.” LIMITS TO GROWTH, *supra* note 3, at 9–10.

60. LIMITS TO GROWTH, *supra* note 3, at 11–12.



reach the growth limits of earth within one hundred years if they remained unchanged.<sup>61</sup> They believed, however, that humans could alter growth trends, but would be more successful in doing so if they decided to do so sooner.<sup>62</sup> The mathematical model presented in the book considers five interactive social problems: “accelerating industrialization, rapid population growth, widespread malnutrition, depletion of nonrenewable resources, and deteriorating environments.”<sup>63</sup> The model considered how a variety of scenarios would result in future states of the world, including effects on human welfare. The central thesis that emerged from the modeling was that unless current trends were checked, civilization would face a catastrophic collapse within one hundred years.<sup>64</sup>

Although the claims were bold, the authors in *The Limits to Growth* were modest in their tone. They forthrightly admitted that the model was “imperfect, oversimplified, and unfinished” but believed it to be “the most useful model now available.”<sup>65</sup> The model was criticized as unnecessarily complicated, too simplistic in aggregating variables, and uncertain in determining the strength of interactions between the inputs to the model.<sup>66</sup> The authors committed to regularly updating their findings, which they have over time.<sup>67</sup>

Responses to *The Limits to Growth* were, predictably, mixed. At the time of publication, some scientists criticized key elements of the work, such as treating the earth as a single system and underestimating human ingenuity to advance technology.<sup>68</sup> Others criticized a lack of transparency surrounding the assumptions input into the model,<sup>69</sup> such as inconsistent use of linear and exponential rates of growth.<sup>70</sup> Some situated the work with other doomsday predictions along the vein of Thomas Malthus.<sup>71</sup>

Later criticism has focused on the accuracy of the predictions.<sup>72</sup> There is widespread disagreement about what the book actually predicted.<sup>73</sup> One paper

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61. *Id.* at 23.

62. *Id.* at 24.

63. *Id.* at 21.

64. *Id.* at 23–24.

65. *Id.* at 21.

66. Brian Hayes, *Computation and the Human Predicament*, 100 AM. SCIENTIST 186, 187 (2012).

67. See LIMITS TO GROWTH, *supra* note 3, at 22; 30-YEAR UPDATE, *supra* note 59.

68. Philip H. Abelson, *Limits to Growth*, 175 SCIENCE 1197, 1197 (1972).

69. *Almost the Last Word on the Club of Rome*, 242 NATURE 147, 147 (1973).

70. Robert Gillette, *The Limits to Growth: Hard Sell for a Computer View of Doomsday*, 175 SCIENCE 1088, 1088 (1972).

71. Francis Sandback, *The Rise and Fall of the Limits to Growth Debate*, SOC. STUD. SCI. 495, 496 (1978).

72. Bjørn Lomborg, *The Limits to Panic*, PROJECT SYNDICATE (June 17, 2013), <https://www.project-syndicate.org/commentary/economic-growth-and-its-critics-by-bj-rn-lomborg> (noting that the predictions were “spectacularly wrong” with regard to commodities and economic collapse).

73. Graham M. Turner, *A Comparison of The Limits to Growth with 30 Years of Reality*, 18 GLOBAL ENVTL. CHANGE 397, 397 (2008) (“many criticisms . . . falsely claim that the LtG predicted resources would be depleted and the world system would collapse by the end of the 20th century.”).

notes: “One interesting bit of misinformation that has been persistently circulating is the idea that the model’s ‘predictions’ have been proven totally wrong by subsequent events (*Economist*, 1997) In fact, the model’s forecasts made in 1972 have been pretty much on target so far.”<sup>74</sup> The authors, in their updates, have suggested that recent sea level rises, evidence of overfishing, and soil loss are indicative of the kinds of natural resources shortcomings that they predicted would lead to collapse.<sup>75</sup> Indeed, “the authors are far more pessimistic than they were in 1972.”<sup>76</sup> But, each time a natural resource behaves contrary to predictions in the book or similar predictions of natural resources success, the entire enterprise of natural resource constraints is called into question.<sup>77</sup>

Beyond the accuracy of the predications, the book has also been criticized on technical grounds about the composition of the model, as well as the political ideologies underlying it.<sup>78</sup> The debate surrounding the book was initially, and remains, vibrant.<sup>79</sup> Despite the mixed reception, *The Limits to Growth* has spurred modeling and empirical work testing its claims, which might have otherwise not occurred. In this sense, it has drawn attention to the problem of resource constraints by defining research questions. The persistent back and forth about the accuracy of its claims has created perceived uncertainty among experts about the constraints of nature to sustain human growth, contrasted with nature as able to rebound from harm,<sup>80</sup> or humans as able to create technological innovation to allow continuous growth.

#### D. Summary of Historical Claims

The above case studies of *Silent Spring*, *The Population Bomb*, and *The Limits to Growth* individually highlight three examples of influential works that spurred real progress towards environmental improvements in the United States, but also suffered varying degrees of backlash because of exaggerated portions of their claims. Here, we briefly summarize the cumulative effects of these books, both in terms of the progress they contributed to generating and also the eventual public weariness with disaster as a mechanism to spur change.

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74. Robert Costanza, Book Review, 59 *ECOLOGICAL ECON.* 397, 398 (2006); see Turner, *supra* note 73.

75. Donella Meadows et al., *A Synopsis: Limits to Growth; The 30-Year Update*, DONELLA MEADOWS INST. (2004), <http://donellameadows.org/archives/a-synopsis-limits-to-growth-the-30-year-update/>.

76. *Id.*

77. See, e.g., Curtis Rist, *Why We’ll Never Run Out of Oil*, *DISCOVER*, June 1999, at 80, 82.

78. The group’s work has been criticized as political and heavily influenced by ideologies; others have called it prophetic. Compare Elodie Vieille Blanchard, *Modelling the Future: An Overview of the ‘Limits to Growth’ Debate*, 52 *CENTAURUS* 91, 112 (2010), with Richard Kool, *Limits to Growth, Environmental Science and the Nature of Modern Prophecy*, 85 *ECOLOGICAL ECON.* 1, 3 (2013).

79. See *supra* notes 69–72.

80. Jesse H. Ausubul, *Nature Rebounds*, Long Now Foundation Seminar, San Francisco (Jan. 13, 2015), [http://phe.rockefeller.edu/docs/Nature\\_Rebounds.pdf](http://phe.rockefeller.edu/docs/Nature_Rebounds.pdf) (suggesting that America decoupled the economy from natural resource exploitation in response to warnings of crisis in the 1970s).

The books were published against an interesting historical backdrop of the 1960s and 1970s, in which the civil rights movement gave hope to new movements. Each book is credited with creating or being a product of the domestic environmental movement of this era. For legal scholars, the most salient feature of this timeframe is the advent of environmental law as a field, created through a series of statutes that remain the primary statutory infrastructure surrounding protecting the natural world and human health in the United States.

The environmental movement of the late 1960s and early 1970s created a groundswell of public support for political action. Congress passed key environmental statutes, such as the Clean Air Act, the Clean Water Act, the National Environmental Policy Act, and the Endangered Species Act. Statutes passed in the 1970s remain key to environmental management today. A scarcity of subsequent environmental laws has made the entire field largely understood as operating around those statutes, with amendments passed in the 1990s.<sup>81</sup> In this sense, by alerting readers to the negative effects of human activity on nature, these authors prompted an unparalleled legal response that has since been used to control a multitude of issues with an arguably good degree of success.<sup>82</sup> One commentator notes:

Arguably the greatest postwar achievement of the U.S. Government and of the policy community is ever-cleaner air and water, accomplished amidst population and economic growth. The environmental record to date shows that government programs can make the nation better and safer without harming prosperity, that industry can be regulated in ways that benefit everyone, that public policy can work.<sup>83</sup>

Each book grabbed public attention through relying on the rhetoric of catastrophe. They combined doomsday predictions with external events and attitudes to create real social and legal change.

More broadly, these books—particularly *Silent Spring*—galvanized a generation of young Americans. Many leading environmentalists, policymakers, and academics of today credit *Silent Spring* with fueling early interest in environmental problems.<sup>84</sup>

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81. See generally Jody Freeman & David B. Spence, *Old Statutes, New Problems*, 163 U. PA. L. REV. 1 (2014) (describing the concern that environmental legislation is out of date, requiring agencies to adopt creative interpretations to fill in gaps for much-needed legislative action). But see Michael P. Vandenbergh, *Private Environmental Governance*, 99 CORNELL L. REV. 129, 130–33 (2013) (describing the time of statutory inaction in environmental law).

82. See Gregg Easterbrook, *Environmental Doomsday: Bad News Good, Good News Bad*, BROOKINGS REV., Spring 2002, at 2, 2.

83. *Id.*

84. Al Gore, *Rachel Carson and Silent Spring*, in COURAGE FOR THE EARTH: WRITERS, SCIENTISTS, AND ACTIVISTS CELEBRATE THE LIFE AND WRITING OF RACHEL CARSON 67 (Peter Matthiessen ed., 2007) (“[Carson’s] example inspired me to write *Earth in the Balance*.”); Leo Hickman, *What Is the Legacy of Rachel Carson’s Silent Spring?* GUARDIAN ENV’T BLOG (Sept. 27, 2012), <http://www.theguardian.com/global/blog/2012/sep/27/rachel-carson-silent-spring-legacy> (noting that Satish Kumar, editor of *Resurgence and Ecologist* magazine, credited Carson as inspiring the work of E.F. Schumacher, Lynn Margulis, and James Lovelock).

The downside of this period of rapt attention to environmental ills was its unsustainability. The environmental movement largely lost steam after about a decade of its inception.<sup>85</sup> The crisis was averted.<sup>86</sup> Or, at least, attention was diverted.<sup>87</sup> Although a variety of factors contributed to the lack of Congressional action on environmental objectives after the 1990s, one basis of concern was that the public became skeptical of environmental experts as their predictions failed to come to fruition, or their proposals created unforeseen consequences.<sup>88</sup> The use of catastrophism to capture attention produced a wearied public.<sup>89</sup> When largely unpredicted events occurred, like the British Petroleum-Deepwater Horizon oil spill, they captured public attention and eclipsed other, less salient environmental problems.<sup>90</sup> The nuanced interconnectedness between the disaster on television and broader, thematic concerns in development and growth were largely lost against the political and economic backdrop of subsequent decades.

The failure of catastrophic predictions to come to fruition undermined the overall credibility of environmental thinkers, including writers and scientists. Right wing conspiracy theorists suggest that environmental alarm is used by government-funded scientists to justify far-reaching government intrusion into private affairs. Consider the following quote, which is emblematic of this perspective:

Government has increasingly seized upon predictions of impending crises to impose restrictions on market adjustments, and by doing so has been increasing the chances for real crises. Those who see their interests furthered by an expanding economic role for government recognize that no claim of impending crisis is too outrageous to be taken seriously by government; and they have responded in turn with ever more outrageous claims.<sup>91</sup>

Such skepticism towards science underscores the most salient environmental issue of our era: climate change. Below, we consider the effects of the legacy of catastrophic environmentalism on climate change politics.

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85. See Freeman & Spence, *supra* note 81, at 8–9 (noting that environmental legislation is marked by inaction, including that Congress has failed to pass major environmental legislation in the past two decades).

86. See Easterbrook, *supra* note 82 (noting that environmental legislation was largely successful).

87. Karen Bradshaw Schulz, *Information Flooding*, 48 IND. L. REV. 755, 767–68 (2015) (noting that public interest in environmental issues is diverted by many competing objectives that, collectively, serve to divert public attention).

88. See *supra* Sections I.A–I.C.

89. *Id.*

90. Karen Bradshaw, *Settling for Natural Resource Damages*, 40 HARV. ENVTL. L. REV. 211, 213–214 (2016) (describing the extent to which a large, salient oil spill captured public, media, and political attention that cast light on a previously overlooked area of natural resource damages).

91. Lee, *supra* note 45, at 50.

## II. THE PRESENT: GLOBAL WARMING CATASTROPHISM

The historical examples discussed above demonstrate that exaggerated claims of catastrophic risks from even real and serious environmental problems can backfire in terms of stimulating public concern and appropriate policy responses.<sup>92</sup> Overstated predictions of doom that are subsequently falsified empirically discredit not only the predictions but also the underlying problem, which may be real and in need of being addressed. This lesson is relevant for today's most pressing environment problem, global climate change. As discussed in subpart A below, the nature of the climate change problem makes it prone to underappreciation by the public and policymakers. This creates the temptation, described in subpart B, for experts who have a better appreciation of the gravity of the problem to overstate its risks and consequences to try to provoke needed public and policy responses. Subpart C concludes by noting the risks of such overstatements, and concludes with recommendations on how to straddle the difficult tension between overstating and understating the risks of global climate change.

### A. The Climate Change Problem

Global climate change may be the most important environmental problem facing the world today, and probably of all time.<sup>93</sup> Significant changes in climate can affect every aspect of human welfare and ecological health, with innumerable anticipated and no doubt many unanticipated impacts.<sup>94</sup> Moreover, it will be the most difficult environmental problem ever to resolve, given that stopping climate change will require a long-term transition of all sectors of the economy to noncarbon energy sources.<sup>95</sup>

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92. There are many historical examples of fears of specific risks that did or did not come to fruition. Examples of risks that were underestimated despite warning signs to the contrary include chlorofluorocarbons (CFCs), asbestos, lead, methyl tertiary-butyl ether (MTBE) in gasoline, and mad cow disease. See generally Eur. Env't Agency, *Late Lessons from Early Warnings: The Precautionary Principle 1896–2000* (2001), [http://www.eea.europa.eu/publications/environmental\\_issue\\_report\\_2001\\_22](http://www.eea.europa.eu/publications/environmental_issue_report_2001_22). Examples of risks that were overestimated and unnecessarily scared people include saccharin, silicone breast implants, Bendectin, "ice minus" bacteria, and the MMR (measles, mumps, and rubella) vaccine. Gary E. Marchant, *From General Policy to Legal Rule: Aspirations and Limitations of the Precautionary Principle*, 111 ENVTL. HEALTH PERSPECT. 1799, 1799 (2003) (focusing on the predictions of catastrophic environmental risk, or the doomsday scenarios, which fortunately have not come true to date in the modern industrial period).

93. See COMM. ON AMERICA'S CLIMATE CHOICES, NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., *AMERICA'S CLIMATE CHOICES* 24–25 (2011); Editorial, *A Commission on Climate Change*, 373 LANCET 1659, 1659 (2009) ("Climate change is the biggest global health threat of the 21st century.").

94. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], *CLIMATE CHANGE 2014 SYNTHESIS REPORT* 64 (2014) [hereinafter IPCC REPORT], [http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5\\_SYR\\_FINAL\\_All\\_Topics.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_All_Topics.pdf).

95. JEFFREY D. SACHS, *THE AGE OF SUSTAINABLE DEVELOPMENT* 394 (2015) ("There has never been a global economic problem as complicated as climate change. It is simply the toughest public policy problem that humanity has ever faced.").

While there is a strong consensus among the vast majority of scientists that climate change is a real and urgent problem,<sup>96</sup> there are aspects of the climate change problem that make it more difficult to convince the public and policy-makers to have the appropriate urgency to take necessary and timely actions to mitigate the problem.<sup>97</sup> For example, most scientists understand that increasing average global temperatures by more than two degrees Celsius would have very serious adverse consequences, and a global increase of as much as four degrees Celsius would have disastrous effects.<sup>98</sup> Yet, most lay people may not appreciate the difference between climate and weather and hence the systemic effects of such temperature increases, noting that their daily temperatures usually shift by much more than four degrees every day, and that most days having the temperature be a couple degrees warmer would be tolerable and in some cases welcomed.<sup>99</sup> Of course, scientists understand that a global increase in overall temperature levels by two degrees is a very different and more significant change than the daily fluctuations in temperatures at any one location, but many nonscientists may not appreciate the difference.<sup>100</sup>

Another important factor is that most severe impacts of climate change are far into the future.<sup>101</sup> The long-term residency time of carbon dioxide in the atmosphere, as well as consequences such as the gradual warming of the oceans, push the most severe and certain consequences decades into the future.<sup>102</sup> While some effects of climate change may already be observed and cause real problems for affected populations,<sup>103</sup> these are more isolated and of more uncertain etiology than the more systemic and dramatic longer-term projections.<sup>104</sup> It is human nature to discount longer-term impacts, both because they are not immediately experienced and thus are more abstract, and because many hope or expect some type of future innovation to solve the problem before its impacts are fully felt. The insidious nature of the climate change problem though is that because of the lag in effects the earth is committed to certain levels of warming long before the impacts occur. This temporal dimension is also likely to cause

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96. See Peter T. Doran & Maggie Kendall Zimmerman, *Examining the Scientific Consensus on Climate Change*, 90 EOS 22, 22–23 (2009).

97. Nico Stehr, *Democracy Is Not an Inconvenience*, 525 NATURE 449, 449 (2015); Mark Triffitt & Travers McLeod, *Hidden Crisis of Liberal Democracy Creates Climate Change Paralysis*, CONVERSATION (Apr. 22, 2015), <https://theconversation.com/hidden-crisis-of-liberal-democracy-creates-climate-change-paralysis-39851>.

98. IPCC REPORT, *supra* note 94, at 65.

99. Susanne C. Moser, *Communicating Climate Change: History, Challenges, Process and Future Directions*, 1 WIRES CLIMATE CHANGE 31, 33–34 (2010).

100. See Patrick J. Egan & Megan Mullin, *Global Warming Feels Quite Pleasant*, N.Y. TIMES, (Apr. 21, 2016), [http://www.nytimes.com/2016/04/24/opinion/sunday/global-warming-feels-quite-pleasant.html?\\_r=0](http://www.nytimes.com/2016/04/24/opinion/sunday/global-warming-feels-quite-pleasant.html?_r=0).

101. Stehr, *supra* note 97, at 450; Moser, *supra* note 99, at 33.

102. IPCC REPORT, *supra* note 94, at 67, 69.

103. *Id.* at 47–49.

104. For example, 2014 and 2015 are the hottest two years on record, an event believed to be attributed to global warming, although the effect of El Nino cannot be excluded. Justin Gillis, *2015 Was Hottest Year in Recorded History, Scientists Say*, N.Y. TIMES, (Jan. 20, 2016), <http://www.nytimes.com/2016/01/21/science/earth/2015-hottest-year-global-warming.html>.

many lay persons and policymakers to underappreciate the need to take mitigation action now.

Finally, the impacts of climate change are more subtle and systemic than some more visible and immediate environmental problems, such as rivers catching fire, smokestacks or tailpipes belching out smelly exhaust, or even cancer causing chemicals in foods or other products.<sup>105</sup> People can easily understand and fear such risks. The more systemic effects of climate change, such as changes to global cycles, alterations in evolutionary patterns, and gradual melting of ice floes seem less immediate and urgent, even though their long-term implications may be more profound. Even though global warming may result in dramatic effects, such as more frequent or violent storms, severe droughts, flooding from sea level rise, or intense heat waves, such effects can also occur from other causes, and so there can never be certainty whether any particular climatic effect is because of man-made climate change or some other factor.<sup>106</sup>

For many environmental problems, such as the risks from hazardous waste sites or nuclear power plants, public fears significantly exceed the concerns of experts.<sup>107</sup> But for the reasons outlined above, the public is prone to underestimate the risks and urgency of climate change relative to expert opinion.<sup>108</sup> Indeed, studies of public opinion on climate change demonstrate such a gap between lay and expert opinion. For example, climate skepticism persists in the United States.<sup>109</sup> This then creates a challenge and dilemma for experts on how to convey the seriousness of climate change without stretching into exaggeration. As Nobel Prize winning economist Daniel Kahneman summarized the situation, “[t]o mobilize people, this has to become an emotional issue. It has to have immediacy and salience. A distant, abstract, and disputed threat just doesn’t have the necessary characteristics for seriously mobilizing public opinion.”

### **C. Temptation to Overstate Climate Change Risks**

There are strong temptations for scientists and advocates to exaggerate the risk of climate change. Dramatic and near-term images of disaster would help to stir the public and policymakers out of their complacency. In the view of one commentator, “when properly qualified, stories of potential catastrophe may sometimes be necessary to wake us out of our slumber, to prompt us to consider

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105. Moser, *supra* note 99, at 33.

106. *Is It Global Warming or Just the Weather?*, ECONOMIST, May 9, 2015, at 54, 54–55.

107. Paul Slovic, *Perception of Risk*, 236 SCIENCE 280, 283 (1987).

108. Robert Gifford, *The Road to Climate Hell*, NEW SCIENTIST, July 11, 2015, at 28–33 (listing 33 cognitive biases and heuristics that explain why the general public is prone to underestimating the climate change problem).

109. Many Americans doubt whether climate change is happening; only 40 percent of Americans believe that human activity is the dominant cause of global warming. Achenback, *supra* note 6 (“Many people in the United States . . . retain doubts about that consensus or believe that climate activists are using the threat of global warming to attack the free market and industrial society generally”).

just what it is that we value about life and our world, and what it is that we don't want to lose."<sup>110</sup>

These temptations towards emphasizing apocalyptic consequences are enhanced by the very real possibility that climate change may be more rapid and catastrophic than even the mainstream scientific projections predict.<sup>111</sup> There is evidence that at least some of the scientific projections of climate change have been overly conservative, and at least some actual changes and consequences are happening more quickly and severely than originally projected.<sup>112</sup> Scientific assessments like those provided by the influential Intergovernmental Panel on Climate Change (IPCC) are consensus documents that tend to represent the "best estimate" of future climate change trends and impacts, and thus may exclude lower probability effects that could come true.

Moreover, these IPCC assessments tend to be based on assumptions of linear change and steady continuation of current trends and effects.<sup>113</sup> But we know that the natural world, including the climate system, tends to be complex and nonlinear rather than simple and linear.<sup>114</sup> Natural systems may be able to absorb some changes while maintaining homeostasis, until the absorptive capacity becomes saturated and then sudden, rapid change occurs in an exponential rather than linear fashion.<sup>115</sup> These changes may be irreversible.<sup>116</sup> Several such potential irreversible "tipping points" have been identified for man-made climate change.<sup>117</sup> Moreover, positive feedback effects can further enhance the nonlinearity of effects.<sup>118</sup>

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110. Jonathan Moo, *Climate Change and the Apocalyptic Imagination: Science, Faith, and Ecological Responsibility*, 50 ZYGON 937, 946 (2015).

111. Stephen H. Schneider, *Abrupt Non-Linear Climate Change, Irreversibility and Surprise*, at 5, OECD Doc. ENV/EPOC/GSP(2003)13/FINAL (Sept. 12, 2003), [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/EPOC/GSP\(2003\)13/FINAL&docLanguage=en](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/EPOC/GSP(2003)13/FINAL&docLanguage=en) [hereinafter Schneider, OECD Workshop Paper]. Schneider prepared the paper for the OECD Workshop on the Benefits of Climate Policy: Improving Information for Policy Makers, which was held December 12–13, 2002.

112. James J. McCarthy, *Reflections On: Our Planet and Its Life, Origins, and Futures*, 326 SCIENCE 1646, 1652–54 (2009). See generally Keynyn Brysse et al., *Climate Change Prediction: Erring on the Side of Least Drama?*, 23 GLOBAL ENVTL. CHANGE 327 (2013) (arguing that many scientific projections of climate change have underpredicted rather than overpredicted actual impacts).

113. COMM. ON ABRUPT CLIMATE CHANGE, NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., ABRUPT CLIMATE CHANGE: INEVITABLE SURPRISES 116, 133 (2002) [hereinafter NRC REPORT ON ABRUPT CLIMATE CHANGE]; Elizabeth Kopits et al., *Incorporating "Catastrophic" Climate Change into Policy Analysis*, 14 CLIMATE POL'Y 637, 638 (2014).

114. NRC REPORT ON ABRUPT CLIMATE CHANGE, *supra* note 113, at 3 ("Physical, ecological, and human systems are imperfectly understood, complex, nonlinear, and dynamic."); Schneider OECD Workshop Paper, *supra* note 111, at 5.

115. For example, the impact of chlorine injections into the upper atmosphere through chlorofluorocarbons and other inorganic chlorine materials had a highly nonlinear impact on stratospheric ozone levels. Ralph J. Cicerone et al., *Nonlinear Response of Stratospheric Ozone Column to Chlorine Injections*, 88 J. GEOPHYSICAL RES. 3647, 3657 (1983).

116. Schneider, OECD Workshop Paper, *supra* note 111, at 6.

117. Yongyang Cai et al., *Environmental Tipping Points Significantly Affect the Cost-Benefit Assessment of Climate Policies*, 112 PROC. NAT'L ACAD. SCI. 4606, 4610 (2015).

118. Kopits et al., *supra* note 113, at 639.



Scientists therefore recognize the potential for such nonlinear phenomena and possible positive feedbacks to result in abrupt climate change that is more rapid and catastrophic than even the grim “business as usual” IPCC projections that attempt to “bracket the uncertainty” predict.<sup>119</sup> One recent assessment of catastrophic climate change identified fifteen potential scenarios that could be considered catastrophic, which were associated with significant uncertainties about likelihood, timing, and consequences.<sup>120</sup> The potential for abrupt and catastrophic consequences that go far beyond the linear projections of most scientific assessments, even if low probability, create what has been described as a “fat tail” of the distribution curve that gives further urgency and importance to preventing such possibilities.<sup>121</sup> The scientific plausibility of nonlinear catastrophic or abrupt consequences, even if low probability, further raises the temptation to emphasize these catastrophic and dramatic effects of climate change to induce greater concern and caution by the public and policymakers.<sup>122</sup>

Stephen Schneider, one of the most prominent climate change scientists before his untimely death in 2010, articulated this “double ethical bind” that scientists face by this temptation to overly dramatize climate change risks:

On the one hand, as scientists we are ethically bound to the scientific method, in effect promising to tell the truth, the whole truth, and nothing but—which means that we must include all the doubts, the caveats, the ifs, ands, and buts. On the other hand, we are not just scientists but human beings as well. And like most people we'd like to see the world a better place, which in this context translates into our working to reduce the risk of potentially disastrous climatic change. To do that we need to get some broad-based support, to capture the public's imagination. That, of course, entails getting loads of media coverage. So we have to offer up scary scenarios, make simplified, dramatic statements, and make little mention of any doubts we might have. This 'double ethical bind' we frequently find ourselves in cannot be solved by any formula. Each of us has to decide what the right balance is between being effective and being honest. I hope that means being both.<sup>123</sup>

It is therefore not surprising that some “[p]oliticians, climate activists, and sometimes scientists regularly resort to the language of impending catastrophe to motivate action and build support for policies intended to mitigate climate change.”<sup>124</sup> And indeed we are already seeing some scientists, journalists, activists, and others giving into such temptations to paint the most bleak and extreme projections of catastrophic climate change. Popular culture is probably the worst offender. For example, the alternative news website Altnet, read by over 5

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119. NRC REPORT ON ABRUPT CLIMATE CHANGE, *supra* note 113, at 1; Schneider, OCED Workshop Paper, *supra* note 111, at 5.

120. Kopits et al., *supra* note 113, at 649–57.

121. Martin L. Weitzman, *Fat Tails and the Social Cost of Carbon*, 104 AM. ECON. REV.: PAPERS & PROC. 544, 546 (2014).

122. Moo, *supra* note 110, at 939.

123. Stephen H. Schneider, *Don't Bet All Environmental Changes Will Be Beneficial*, APS NEWS, Aug.–Sept. 1996, <http://www.aps.org/publications/apsnews/199608/environmental.cfm>.

124. Moo, *supra* note 110, at 939–40.

million different users per month,<sup>125</sup> ran an article stating that climate change would result in the extinction of foods such as apples, beer, rice, seafood, chocolate, coffee, wine, french fries, and peanut butter.<sup>126</sup> CNN founder Ted Turner stated on the Charlie Rose show that if steps are not taken to mitigate climate change, in 30 or 40 years “[m]ost of the people will have died and the rest of us will be cannibals . . . [c]ivilization will have broken down. The few people left will be living in a failed state—like Somalia or Sudan—and living conditions will be intolerable.”<sup>127</sup> *Rolling Stone* magazine ran a story entitled “Apocalypse Soon: 9 Terrifying Signs of Environmental Doom and Gloom” in which it suggested that climate change may be partially to blame for the Syrian war and the Islamic State of Iraq and Syria (ISIS).<sup>128</sup> The movie *Day After Tomorrow* portrays a highly unlikely scenario of abrupt climate change that destroys most of the world in a matter of a few days.<sup>129</sup>

Some scientists have also gone down a similar sensationalist path. For example, James Hansen, a leading climate change scientist in the U.S. government for many years, left the government to pursue a more activist approach to battling climate change.<sup>130</sup> Hansen and his coauthors subsequently published a highly publicized study in a non-peer-reviewed journal. The study claimed that if climate change is not promptly addressed, rapid melting of continental ice sheets could lead to catastrophic consequences:

Our analysis paints a different picture than IPCC (2013) for how this Hyper-Anthropocene phase is likely to proceed if [greenhouse gas] emissions grow at a rate that continues to pump energy at a high rate into the ocean. We conclude that multi-meter sea level rise would become practically unavoidable. Social disruption and economic consequences of such large sea level rise could be devastating. It is not difficult to imagine that conflicts arising from forced migrations and economic collapse might make the planet ungovernable, threatening the fabric of civilization.<sup>131</sup>

Other leading climate change scientists criticized this extreme scenario as going beyond the evidence. For example, Kevin Trenberth, Distinguished Senior Scientist at the National Center for Atmospheric Research, wrote that the study “is

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125. *About AlterNet*, ALTERNET, <http://www.alternet.org/about> (last visited Jul. 25, 2016).

126. Reynard Loki, *Sorry, You Can't Have Fries with That: 10 Foods That May Disappear Thanks to Climate Change*, ALTERNET (Dec. 27, 2015), <http://www.alternet.org/environment/10-foods-may-disappear-due-climate-change>.

127. Quoted in Mark Frauenfelder, *Ted Turner: Global Warming Could Lead to Cannibalism*, BOINGBOING (Apr. 3, 2008), <http://boingboing.net/2008/04/03/ted-turner-global-wa.html>.

128. John Knefel, *Apocalypse Soon: 9 Terrifying Signs of Environmental Doom and Gloom*, ROLLING STONE (Aug. 18, 2015), <http://www.rollingstone.com/culture/news/apocalypse-soon-9-terrifying-signs-of-environmental-doom-and-gloom-20150818>.

129. See Mattias Hjerpe & Bjorn-Ola Linner, *Utopian and Dystopian Thought in Climate Change Science and Policy*, 41 *Futures* 234, 240 (2009).

130. Justin Gillis, *Climate Maverick to Retire from NASA*, N.Y. TIMES, (Apr. 1, 2013), [http://www.nytimes.com/2013/04/02/science/james-e-hansen-retiring-from-nasa-to-fight-global-warming.html?pagewanted=all&\\_r=0](http://www.nytimes.com/2013/04/02/science/james-e-hansen-retiring-from-nasa-to-fight-global-warming.html?pagewanted=all&_r=0).

131. James Hansen et al., *Ice Melt, Sea Level Rise and Superstorms: Evidence from Paleoclimate Data, Climate Modeling, and Modern Observations that 2 °C Global Warming Is Highly Dangerous*, 15 *ATMOSPHERIC CHEM. PHYS. DISCUSS.* 20059, 20119 (2015).

rife with speculation and ‘what if’ scenarios,” contains “many conjectures and huge extrapolations based on what I see as quite flimsy evidence,” and seems to have “gone out of its way to make the case, stretching credibility.”<sup>132</sup>

Many authors and proponents of aggressively addressing climate change go even further and expressly describe the risks of climate change in apocalyptic or dystopian terms.<sup>133</sup> For example, climate change journalist Ross Gelbspan writes that “the consequences of planetary warming are . . . terrifying—a cascade of environmental effects that could shake our civilization off its foundation altogether. The catalog of anticipated effects is familiar—it reads like the biblical apocalypse.”<sup>134</sup>

Even more problematic is when such dire apocalyptic predictions are associated with specific dates, especially when those dates come and go. In 2005 the United Nations Environmental Programme (UNEP) predicted that there would be 50 million “climate refugees” by 2010, even displaying a map showing where these displaced citizens would likely come from.<sup>135</sup> When 2010 came and went, no such dislocations had occurred, and many of the most vulnerable sites identified by UNEP were instead experiencing robust population growth.<sup>136</sup> UNEP took the map down from its website, and defensively asserted that while “[l]ooked at today, the map over-simplifies the message, which is why we asked for it to be removed,” but nonetheless insisted the problem of climate refugees remained valid.<sup>137</sup>

In another example, one of the early influential books sounding the alarm about climate change was *Dead Heat: The Race Against the Greenhouse Effect* coauthored by Michael Oppenheimer, then the Chief Scientist at the Environmental Defense Fund, and now a prominent and frequently cited climate scientist at Princeton University. In this book, published in 1990, the authors presented a scenario of the future if nothing is done to mitigate climate change. It described that by 1995 food riots would break out in the Soviet Union that would cause political changes resulting in brutal repression.<sup>138</sup> By 1996, a “black blizzard” would have blown away the prairie topsoil of sixteen states and

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132. Kevin Trenberth, *Study Predicts Multi-Meter Sea Level Rise This Century, But Not Everyone Agrees*, CONVERSATION, July 23, 2015, <https://theconversation.com/study-predicts-multi-meter-sea-level-rise-this-century-but-not-everyone-agrees-45139>.

133. Erik Swyngedouw, *Apocalypse Forever? Post-Political Populism and the Spectre of Climate Change*, 27 THEORY, CULTURE & SOC’Y 213, 216 (2010) (“[A]pocalyptic imaginaries . . . infuse the climate change debate . . . through which much of the public concern with the climate change argument is sustained”); Hjerpe & Linner, *supra* note 129, at 240–41. See generally STEFAN SKRIMSHIRE, *FUTURE ETHICS: CLIMATE CHANGE AND APOCALYPTIC IMAGINATION* (2010).

134. ROSS GELBSPAN, *THE HEAT IS ON* 10–11 (1997).

135. Editorial, *Climate Refugees, Not Found; Discredited by Reality, the U.N.’s Prophecies Go Missing*, WALL ST. J., Apr. 21, 2011, at A12.

136. *Id.*

137. Achim Steiner, Editorial, *Climate Migration Will Not Wait for Scientific Certainty on Global Warming*, GUARDIAN (May 11, 2011, 7:25 AM), <https://www.theguardian.com/environment/2011/may/11/climate-change-scientific-evidence-united-nations>. Steiner was the executive director of the United Nations Environment Programme (UNEP) when the editorial was written.

138. MICHAEL OPPENHEIMER & ROBERT H. BOYLE, *DEAD HEAT: THE RACE AGAINST THE GREENHOUSE EFFECT* 8–9 (1990).

the Canadian Maritimes, and the blowing dust would have “penetrated the lungs of cattle, stopped traffic on interstates, stripped paint from houses, and shut down computers.”<sup>139</sup> These winds would leave “only the heavy sands that now bury parts of the western plains under drifting dunes.”<sup>140</sup> The Platte River in Nebraska would have dried up in the same time period,<sup>141</sup> while “in Mexico police [would begin] rounding up illegal American migrants working in the fields around Monterrey.”<sup>142</sup> Catastrophic fires would burn across the nation, making it impossible to see across the Grand Canyon for six months of the year, and “the smoke and heat . . . [would drive] people out of Phoenix and Tucson and back to the north.”<sup>143</sup> Furthermore, the scenario predicted that “[b]y 2015 more than 30 percent of southeastern farmland [would have] been abandoned. . . . Southerners [would be] on edge, civility [had gone] out the window. . . . Crime and drug use [had] soared. . . . The Miami Dolphins [had] moved to Calgary, and the Tampa Bay Buccaneers [had] joined the Atlanta Braves in Edmonton.”<sup>144</sup>

Of course none of these terrible things have happened. They may in the future, but it is now more than two decades after many of the parade of horrors that the book predicted to occur by the mid-1990s. People reading this book in 1990 when it was published may have been frightened by the urgency of the impending doom; people reading the book today can empirically determine that the book vastly exaggerated the severity and timing of the impacts of climate change. So what is the public supposed to think when scientists like Oppenheimer sound the alarm today about the urgency of tackling climate change? There may be a growing urgency to address climate change today, but the credibility of such calls to action will progressively become weaker as the earlier predictions and projections fail to come true. As the Director of the Tyndall Centre for Climate Change Research warned, the risks of climate change “are significant enough without invoking catastrophe and chaos as unguided weapons with which forlornly to threaten society into behavioral change.”<sup>145</sup>

#### **D. The Risks of Exaggerating Climate Change Risks**

Exaggerating the risk of climate change for cathartic effect carries several risks. First and foremost, exaggerated predictions of catastrophe may be misleading and result in a backlash against the climate change problem in general, just as we saw with the previous claims of exaggerated fears of pollution, population explosion, and natural resource exhaustion. While those were real problems, just like climate change is a real problem, once the public, other experts and policymakers lost confidence in the veracity of the most dire projections, it undermined support and concern for the issue overall. In the same way, dire climate change predictions, especially when they are attached to specific dates

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139. *Id.* at 9.

140. *Id.*

141. *Id.*

142. *Id.* at 11.

143. *Id.*

144. *Id.* at 12–13.

145. Mike Hulme, *Chaotic World of Climate Truth*, BBC NEWS (Nov. 4, 2006), <http://news.bbc.co.uk/2/hi/science/nature/6115644.stm>.

that come and go without the predictions coming true, undermine the credibility of the calls for action, which may be quite justified.

Even though the world has recently taken some initial steps to address climate change through the Paris Agreement negotiated in December 2015,<sup>146</sup> there is a long road ahead before climate change will be sufficiently addressed, with much more actions and sacrifices needed beyond those agreed to in Paris, even if they are fully implemented (which is questionable).<sup>147</sup> Addressing climate change will require many decades of dedication and commitment, which will require the public and policymakers to remain steadfast in their determination to make the changes and sacrifices needed to address the problem. If the predictions of gloom and doom with specific timelines start passing unfulfilled, the political support for continuing down the path of climate change solutions will lag and sag. So even if scary projections do motivate strong actions in the short term, they may undercut the support for decisive action in the long run, which is absolutely imperative for a sustainable solution.

Moreover, some commentators argue that catastrophic visions are not necessary to communicate the urgency of addressing climate change, in that the evidence of a problem is sufficiently compelling to justify and (eventually) stimulate appropriate mitigation policies without resorting to apocalyptic scenarios.<sup>148</sup> Another criticism of the apocalyptic framing of climate change is that it suggests an “absolutist” approach to the problem that dominates all other problems, whether they be environmental, economic, or health concerns of the present.<sup>149</sup> Thus, this extreme framing of the climate change problem may divert resources and attention away from addressing other unmet human needs of the present.<sup>150</sup>

Finally, exaggerated claims of climate catastrophism are criticized as ineffective.<sup>151</sup> While the goal of such strong claims is to motivate the public and policymakers to take action, apocalyptic predictions may instead cause people to feel helpless and despair, pushing them into apathy and escapism rather than productive action.<sup>152</sup>

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146. See Jeff Tollefson & Kenneth R. Weiss, *Nations Adopt Historic Global Climate Accord*, 528 NATURE 315, 315 (2015).

147. *Id.* at 316.

148. Hulme, *supra* note 145 (“The language of fear and terror operates as an ever-weakening vehicle for effective communication or inducement for behavioral change.”).

149. There is an important distinction between saying that global climate change is the most serious environmental problem we face and must be addressed (a view shared by the present authors) from a more absolutist viewpoint that contends that nothing else matters if we do not fix climate change. The latter view would argue for diverting all efforts and resources away from other pressing environmental and nonenvironmental problems to devote to climate change.

150. MIKE HULME, WHY WE DISAGREE ABOUT CLIMATE CHANGE 362–64 (2009); Moo, *supra* note 110, at 940.

151. Moo, *supra* note 110, at 940–41.

152. *Id.* at 941.



Exaggerated claims of climate change risks and consequences by journalists, activists and scientists, and especially claims of apocalyptic outcomes, may arguably catalyze public and policymaker action in the short term, but could undermine the long-term commitment to battling climate change. While most scientists are careful in their statements and provide the necessary caveats and uncertainties, and in many cases may even understate risks,<sup>153</sup> it is the most sensational claims that garner the largest attention, just as was the case with the exaggerated claims of environmental doomsday in the 1960s and 1970s. But as we saw from that earlier era, exaggerated claims not only discredit the individuals making the overstatements, they undermine the credibility of the entire issue and cause public commitment to wane and grow weary.

Even if understated and presented with the most conservative projections, climate change is a major problem that warrants urgent action at the national and global level. Real-world observations that the climate is changing more quickly or more significantly than originally projected will galvanize the efforts and commitment to do something about the problem. On the other hand, if real-world observations show that climate change projections were overestimated, even if it is just the most extreme projections that are contradicted, public and government commitment to fighting climate change will be undermined, as happened with the worst-case projections of environmental doom in the 1960s and 1970s. We cannot afford such erosion of public support and confidence in the long-term effort to address global climate change.

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153. Brysse et al., *supra* note 112, at 328–31.