

SPECIAL PREVIEW:

Climate Change Beyond Environmentalism Part I: Intersectional Threats and the Case for Collective Action

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INTRODUCTION

In August 2016, Russian public health officials were scrambling to deal with an outbreak of deadly anthrax, which began with the mysterious mass die-off of

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2,300 reindeer, and then proceeded to kill a 12-year-old boy named Denis and hospitalize more than 70 others.¹ An investigation revealed the outbreak was not an act of terrorism, nor did the dangerous spores escape from a crumbling cold-war chemical weapons laboratory. Instead, unprecedented 90-degree-plus temperatures melted the Siberian permafrost, exposing an infected reindeer carcass that had been frozen for more than 75 years.² The dormant anthrax spores released after decades of hibernation are believed to have first spread to animals that fed on the carcass, and then jumped to humans in short order.³ The frightening reemergence of the deadly spores after decades of being locked in the ice was actually predicted in 2011 by Russian scientists, who warned that melting permafrost from climate change could release “the vectors of deadly infections of the 18th and 19th centuries . . . especially where the victims of these infections were buried.”⁴

In December 2015, two hundred of the world’s countries came together in Paris to forge a new international agreement to reduce the global warming emissions that took the life of Denis, and which are already killing and displacing large numbers of both humans and animals across the globe. To date, more than 100 countries have ratified the Paris Agreement, which is on course to become one of the largest international agreement ever adopted.⁵ The crux of the Agreement is each nation’s commitment to use its own laws to reduce domestic

1. *Anthrax Outbreak in Russia Thought to be Result of Thawing Permafrost* (National Public Radio Aug. 3, 2016, 8:32 PM).

2. *Id.*; see also Nick Visser, *Siberian Heatwave Sparks Anthrax Outbreak, Killing a Child and Thousands of Reindeer*, THE HUFFINGTON POST (Aug. 2, 2016, 7:09 PM), http://www.huffingtonpost.com/entry/siberia-anthrax-reindeer_us_57a11c78e4b0693164c32de5.

3. See Visser, *supra* note 2.

4. Boris A. Revich & Marina A. Podolnaya, *Thawing of Permafrost May Disturb Historic Cattle Burial Grounds in East Siberia*, 4 GLOBAL HEALTH ACTION 1 (2011) (“Climate change in the Arctic may increase the risk of propagation of vector habitats and development of more favorable climatic conditions for their survival . . .”). Anthrax is not the only deadly vector poised to reemerge from the melting ice. See Ashleigh Davis, *How Killer Virus Smallpox Could Be About to Make a Zombie-Like Return—After Being Eradicated Worldwide in 1980*, DAILY MAIL (Aug. 28, 2016), <http://www.dailymail.co.uk/news/article-3762279/Killer-virus-smallpox-make-zombie-like-return-Australia-eradicated-worldwide-1980.html>.

5. See Michael Astor, *Paris Climate Agreement to Take Effect Nov. 4*, ASSOCIATED PRESS (Oct. 5, 2016), <http://bigstory.ap.org/article/9daff3d1c8c9413f99224d5057f0b096/paris-climate-agreement-take-effect-30-days>; Alister Doyle, *Paris Climate Accord to Take Effect: Obama Hails ‘Historic Day’*, REUTERS (Oct. 5, 2016), <http://www.reuters.com/article/us-climatechange-paris-idUSKCN12523G>.

Greenhouse Gas (“GHG”) emissions to meet the targets contemplated by the Agreement.⁶

This domestic mandate is a tall order. For the United States, as with other signatories, success or failure depends entirely upon the level of public pressure and political power exerted to compel action. The Paris Agreement’s goal of holding global temperature change to no more than two degrees Celsius by 2050 is at best ambitious, and will require transformative change across key sectors of the national economy.⁷ However, the likelihood of the United States executing this mandate is exceedingly low.

Indeed, the last two decades of climate change politics suggest that political and legislative action to seriously reduce climate change emissions may be both unrealistic and unworkable.⁸ The fundamental problem in the United States is that climate change is perhaps the most academically studied yet publicly misunderstood major policy issue of the last hundred years. Most Americans have virtually no idea what is at stake when it comes to the impacts of climate change, nor how these changes will affect their communities, their homes, their families, or their finances in the near future.

Annual polling conducted by the Yale Program on Climate Change Communication and the George Mason University Center for Climate Change Communication reveals a substantial disconnect between the scientific community’s views of climate change and those of the general public.⁹ According

6. Sandrine Maljean–Dubois, *The Paris Agreement: A New Step in the Gradual Evolution of Differential Treatment in the Climate Regime?*, 25 REV. EUR. COMP. & INT’L ENVTL. L. 151, 155 (2016) (“[E]ach party has the obligation to ‘prepare, communicate and maintain successive nationally determined contributions that it intends to achieve. Parties shall pursue domestic mitigation measures, with the aim of achieving the objectives of such contribution.’”) (quoting Paris Agreement to the United Nations Framework Convention on Climate Change art. 4.2, Dec. 12, 2015, T.I.A.S. No. 16–1104).

7. See Oliver Milman, *U.S. Emissions Set to Miss 2025 Target in Paris Climate Change Deal, Research Finds*, THE GUARDIAN (Sept. 26, 2016), <https://www.theguardian.com/science/2016/sep/26/us-climate-change-emissions-miss-2025-target-research> (“even if the president’s centerpiece Clean Power Plan was to go ahead, the US would fall short of its target by 551m to 1.8b tonnes of greenhouse gasses” without additional measures to reduce emissions).

8. See DALE JAMIESON, REASON IN A DARK TIME: WHY THE STRUGGLE AGAINST CLIMATE CHANGE FAILED—AND WHAT IT MEANS FOR OUR FUTURE 4 (2014) (providing the definitive study of why existing public institutions have failed to stem the tide of what Professor Jameison calls “the world’s largest collective action problem”).

9. ANTHONY LEISEROWITZ ET AL., YALE U. & GEO. MASON U., CLIMATE CHANGE IN THE AMERICAN MIND 3 (Oct. 2016).

to the most recent poll, only about one-in-ten Americans is aware that virtually all climate scientists agree that human-caused global warming is happening now.¹⁰ A thin majority of Americans (53%) believe that global warming, if it exists, is caused by humans.¹¹ Only 37% of Americans think that the American people can convince Congress to pass the legislation necessary to reduce global warming.¹²

These troubling statistics are partially attributable to the unyielding views of many current national political leaders—the only people who could readily initiate nationwide regulatory strategies to mitigate or reduce the impacts of climate change. More than half of the Republican Congressional majority—59% of the House Republican caucus and 70% of Senate Republicans—deny that human-caused climate change exists.¹³ The House Committee on Science has launched a campaign to subpoena and harass climate change scientists,¹⁴ while other members had sought to impeach former Environmental Protection Agency (EPA) Administrator Gina McCarthy¹⁵ and undermine the credibility of the EPA¹⁶—all for expressing views concerning global warming that are considered established facts in other Western democracies.¹⁷

10. *Id.* at 8.

11. *Id.* at 7.

12. *Id.* at 20.

13. Kristen Ellingboe & Ryan Koronowski, *Most Americans Disagree with Their Congressional Representative on Climate Change*, THINKPROGRESS (Mar. 8, 2016), <https://thinkprogress.org/most-americans-disagree-with-their-congressional-representative-on-climate-change-95dc0eee7b8f#9heamb3ah>.

14. Juan Carlos Rodriguez, *House Science Chair Subpoenas NY, Mass. AG Climate Docs*, LAW360 (July 13, 2016), <http://www.law360.com/articles/816969/house-science-chair-subpoenas-ny-mass-ag-climate-docs> (detailing how the Chair of the House Committee on Science subpoenaed two attorneys general and eight environmental organizations for alleged collusion to attack climate change skeptics); *Is this Congressman's Oversight an Effort to Hobble Climate Science?*, (National Public Radio Dec. 7, 2015) (detailing how the Chair of the House Committee on Science has launched a campaign to investigate scientists at the National Oceanic and Atmospheric Administration).

15. Devin Henry, *GOP Lawmaker Looks to Impeach EPA Chief*, THE HILL (Sept. 9, 2015), <http://thehill.com/policy/energy-environment/253079-republican-rep-looks-to-impeach-epa-chief-mccarthy>; see also Paul Gosar, *It's Time to Impeach EPA Administrator Gina McCarthy*, CONGRESSMAN PAUL GOSAR (Nov. 16, 2016), <http://gosar.house.gov/blocking-epas-harmful-wotus-regulation>.

16. See, e.g., Devin Henry, *'Un-American' Charge Ignites Hearing on EPA Rules*, THE HILL (July 6, 2016), <http://thehill.com/policy/energy-environment/286667-un-american-charge-ignites-hearing-on-epa-rules>.

17. See Sondre Båtstrand, *More Than Markets: A Comparative Study of Nine Conservative Parties on Climate Change*, 43 POL. & POL'Y 538, 552 (2015) (surveying conservative parties in

Most efforts by the Obama administration and congressional Democrats to seriously grapple with climate change were repeatedly thwarted by such attitudes.¹⁸ Although some climate emission regulations were enacted, more comprehensive efforts proved much more difficult. Even the relatively modest Clean Power Plan adopted by the EPA triggered a legal “civil war” between dozens of State Attorneys General,¹⁹ and an unprecedented preemptive injunction from the Supreme Court.²⁰ The election of Donald Trump—and his appointment of prominent climate change skeptic Scott Pruitt to lead the EPA—only highlights how swiftly the existing and already tenuous emissions control structure could be repealed by Congress or the President no matter the outcome in the courts.²¹

Thus, there is little reason to believe that the legislative and executive branches have the capacity to undertake the type of far-reaching policy changes required to meet the Paris Agreement’s ambitious goals. Instead, it is far more likely that the Agreement itself will continue to be a partisan political football,

Europe, the U.S., and Australia, and finding that “[c]onservatives have been accused for downplaying the importance of climate change, but only the Republican Party in the United States has chosen this approach in its electoral manifesto, while the rest of the parties acknowledge climate change as a problem.”).

18. See, e.g., Puneet Kollipara, *In Symbolic Move, Congress Votes to Gut Obama Climate Plans*, SCI. (Dec. 2, 2015), <http://www.sciencemag.org/news/2015/12/symbolic-move-congress-votes-gut-obama-climate-plans>; Coral Davenport, *Senate Democrats Offer Climate Change Bill Aimed Not at Success Now, but in 2016*, N.Y. TIMES (Sept. 22, 2015), <http://www.nytimes.com/2015/09/23/us/politics/senate-democrats-to-unveil-aggressive-climate-change-bill.html>; Tom Zeller Jr., *Obama Makes Global Climate Pledge, But GOP Has Other Ideas*, FORBES (Apr. 1, 2015), <http://www.forbes.com/sites/tomzeller/2015/04/01/obama-makes-global-climate-pledge-but-gop-has-other-ideas/#2c8ae3a059d0>.

19. See Brent Kendall, *Coalition of 18 States to Move to Defend Carbon-Emissions Rules*, WALL STREET J. (Nov. 4, 2015), <http://www.wsj.com/articles/coalition-of-18-states-to-move-to-defend-carbon-emissions-rules-1446613261>.

20. L. Heinzerling, *The Supreme Court's Clean-Power Power Grab*, 28 GEO. ENVTL. L. REV. 425–40 (2016); L. Denniston, *Carbon Pollution Controls Put on Hold*, SCOTUSBLOG (Feb. 9, 2016).

21. Robinson Meyer, *How Obama Could Lose His Big Climate Case*, THE ATLANTIC (Sept. 29, 2016), <http://www.theatlantic.com/science/archive/2016/09/obama-clean-power-plan-dc-circuit-legal/502115/>; Carolyn Beeler, *The Next President Could Make or Break the Paris Climate Agreement*, PUB. RADIO INT’L (Mar. 3, 2016), <http://www.pri.org/stories/2016-03-03/next-president-could-make-or-break-paris-climate-agreement>; Ben Adler, *Here’s How a Republican President Could Undermine the Clean Power Plan*, GRIST (Aug. 5, 2015), <http://grist.org/climate-energy/heres-how-a-republican-president-could-undermine-the-clean-power-plan/>; Evan Lehmann, *Republican Platform Rejects Paris Climate Agreement*, SCI. AM. (July 19, 2016), <https://www.scientificamerican.com/article/republican-platform-rejects-paris-climate-agreement/>.

and a glowing-hot third rail for any national candidate or undercard politician seeking to stake out a centrist position for years to come.²²

This paper is Part I of a two-part series discussing some of the key obstacles to effective climate emissions control efforts in the United States and exploring potential solutions. The most fundamental obstacle, of course, is the inherent inability of existing domestic and international regulatory institutions to provide meaningful solutions to avert a climate crisis. For the purposes of these papers, the intransigence of current political leaders, and the resulting paralysis of existing regulatory bodies, will be treated as a given—*quod erat demonstrandum*—and a jumping off point for exploring alternate climate policy solutions. Thus, these papers will focus on potential climate change strategies that do not require any new statutory, regulatory, or other action by Congress, federal agencies, or state legislatures. Instead, the discussion will focus on ideas for reshaping public-interest organizations’ legal and policy strategy, consumer preferences, and corporate behavior.

This paper explores one such potential strategy: dispelling the misconception that climate change is a narrow special-interest issue for environmental advocates rather than a collective, existential threat to a multitude of social, economic, and business interests, and then enlisting non-traditional climate stakeholders in a cause that has expanded far beyond the ability of the environmental movement to handle on its own. The paper will discuss the wide-ranging intersectional impacts of climate change on a number of domestic social movements and the pressing need to reconfigure the public debate over climate change to resonate with people who do not self-identify as environmentalists.

The case must be made that the impacts of climate change are not equal-opportunity threats. Rather, such impacts are profoundly discriminatory, falling hardest upon the most vulnerable elements of society, including certain populations of women, children, the economically disadvantaged, people of color, animals, and the natural environment. Taking serious action against climate change is dependent in large part on redefining the problem as an overarching

22. Oliver Milman, *Climate Change May Be a Burning Issue—But Election Campaign Tells Another Story*, THE GUARDIAN (Mar. 26, 2016), <https://www.theguardian.com/us-news/2016/mar/26/climate-change-may-be-a-burning-issue-but-election-campaign-tells-another-story>; Jeff McMahon, *Climate Change Can’t Get Traction in this Election, but Clean Energy Can*, FORBES (Oct. 2, 2016), <http://www.forbes.com/sites/jeffmcmahon/2016/10/02/climate-change-cant-get-any-traction-in-this-election-but-clean-energy-can/#61e7fada2eed>.

social justice issue that transcends traditional public interest labels, such as environmental law, public health, or civil rights.

As a first step toward building a more inclusive and effective climate coalition, this paper proposes the immediate mobilization of the animal protection community on climate change, and the reactivation of the historic alliance between animal protection and environmental advocates. The track record of success for these two movements when working together is impressive.²³ For more than a century the two causes have shared a common ethic of wildlife protection and worked hand-in-hand to deliver some of the most important environmental policy gains of the last fifty years, including the Endangered Species Act, the Marine Mammal Protection Act, and a host of other wildlife protection laws. This history of collective success for wildlife is significant because the mass destruction of billions of animals due to climate change is already underway and is one of the major harbingers of more widespread human impacts to follow. Thus, the climate change threat to wildlife is, in some ways, the ideal catalyst for these two closely-related movements to set an example of collective action on climate change.

This paper begins with a brief overview of climate change in Section I to provide the reader with the scientific background needed to engage later discussions. Section II provides an overview of the current international and domestic legal framework for climate change emissions regulation. Section III deconstructs the misconception that climate change emissions are merely an environmental issue, describes the threat they pose to a multitude of public interest movements, and explains why the impacts of climate change are falling disproportionately on the most vulnerable elements of our society. Section IV discusses ways to expand the language of climate change to embrace a broad diversity of climate stakeholders, makes the case for the immediate engagement of the animal protection community, and advocates for the unification of

23. See L. Johnson, *Pushing NEPA's Boundaries: Using NEPA to Improve the Relationship Between Animal Law and Environmental Law*, 17 N.Y.U. ENVTL. L.J. 1367, 1378 (2009) (detailing common legal issues between the movements—including wildlife, habitat, and agriculture issues—and how the movements have addressed them together and separately); D. Hill, *Combating Animal Cruelty with Environmental Law Tactics*, 4 J. ANIMAL L. 19, 2424–38 (2008) (detailing how animal protection advocates have employed the Clean Water Act, the Clean Air Act, the Migratory Bird Treaty Act, and the National Environmental Policy Act to combat animal cruelty).

environmental and animal protection advocates as a first step along the path to broad, collective action on climate change.

The next paper in the series will propose both a strategic focus and potential tactics for this broad climate coalition. That paper will discuss the need to refocus advocacy efforts on GHG emission sources that, if cut immediately, might dissipate in time to mitigate some of the impacts of climate change. Because of the long-term damage already done by more than a century of unregulated carbon emissions,²⁴ and the long lifespan of carbon in the atmosphere, even immediate (and unlikely) reductions in carbon emissions would take many decades to have any significant effect on the human-caused warming already underway, and thus arrive too late to mitigate the devastating impacts of climate change.²⁵

Methane emissions, on the other hand, may provide a more fruitful strategic opportunity for near-term mitigation. Although much smaller than carbon in the overall portfolio of GHG emissions, methane is eighty-six times more potent a global warming agent than carbon over a twenty-year timeframe, but unlike carbon, it dissipates in just a few years.²⁶ Thus, one strategy is to look beyond the much-discussed issue of CO₂ emissions from the energy sector and address lesser-known but important methane emission sources. A study released in December 2016 entitled “*The Growing Role of Methane in Anthropogenic Climate Change*,” found that “[u]nlike CO₂, atmospheric methane concentrations are rising faster than at any time in the past two decades,” that “the rapid rise in

24. Brian Kahn, *The World Passes 400ppm Carbon Dioxide Threshold. Permanently*, CLIMATE CENTRAL (Sept. 27, 2016), <http://www.climatecentral.org/news/world-passes-400-ppm-threshold-permanently-20738>; Cheyanne Macdonald, *Global Warming Milestone as Scientists Warn Earth Has Passed Carbon Tipping Point ‘For Good’*, DAILY MAIL (Sept. 28, 2016), <http://www.dailymail.co.uk/sciencetech/article-3812087/Global-warming-milestone-scientists-warn-Earth-passed-carbon-tipping-point-good.html>.

25. See Thomas L. Frolicher et al., *Continued Global Warming After CO₂ Emissions Stoppage*, 4 NATURE CLIMATE CHANGE 40 (2014) (noting that even if all CO₂ emissions stopped immediately, it would take up to 1,000 years for existing carbon to dissipate, and that “limited warming to 2 degrees would require keeping future cumulative carbon emissions below 250 billion tons, only half of the already emitted amount of 500 billion tons”); Jeffrey B. Greenblatt & Max Wei, *Assessment of the Climate Commitments and Additional Mitigation Policies of the United States*, NATURE CLIMATE CHANGE 1 (Sept. 26, 2016) (concluding that the U.S.’s “current intended nationally determined contributions are insufficient to meet the Paris Agreement goal of limiting temperature change to between 1.5 and 2.0 degrees C above pre-industrial levels”).

26. See Scot M. Miller et al., *Anthropogenic Emissions of Methane in the United States*, 50 PROC. NAT’L ACAD. SCI. 20018, 20018 (Dec. 10, 2013); JOSEPH ROMM, CLIMATE CHANGE: WHAT EVERYBODY NEEDS TO KNOW 81 (2016).

global methane concentrations is predominantly biogenic—most likely from agriculture,” and that “[m]ethane mitigation offers rapid climate benefits.”²⁷

However, methane emissions from animal and plant agriculture remain totally unregulated and are often ignored in climate policy discussions, including the Paris Agreement. This blindness to one of the largest sources of controllable methane emissions not only frustrates efforts at meaningful climate change mitigation over the near-term,²⁸ it also has the potential to let agricultural emissions backfill and neutralize the benefits of any emission reductions achieved under the Paris Agreement and other regulatory efforts. Without a holistic approach to emissions reductions, we could be engaged in the strategic equivalent of digging a hole while someone else fills it.

With regard to tactics, the next paper will propose that climate advocates look beyond a decrepit environmental law regulatory apparatus first developed almost fifty years ago—and which was never intended to address GHG emissions—and instead prioritize a model of social change that is not dependent on federal or state political leaders. In this regard climate advocates might look to the legal and policy tactics deployed by the animal protection movement over the last decade—wherein major animal abuse issues have been tackled and controlled primarily

27. Marielle Saunio, et al., *The Growing Role of Methane in Anthropogenic Climate Change*, 11 ENVTL. RES. LETTERS 120207 (2016) (“Methane emissions from increasing agricultural activities seem to be a major, possibly dominant, cause of the atmospheric growth trends of the past decade.”); see also George D. Banks, AM. COUNCIL FOR CAPITAL FORMATION, SUCCESS OF U.S. CLIMATE PLEDGE DEPENDS ON FUTURE GHG REGULATION OF U.S. INDUSTRY, OTHER SECTORS 6, 7 (2015) (detailing how to meet the Obama Administration’s climate pledge to the United Nations; it will be necessary to regulate not just the energy, transportation, and industrial sectors but also other sectors like land use and agriculture); Seth Borenstein, *Scientists: World Likely Won’t Avoid Dangerous Warming Mark*, ASSOCIATED PRESS (Sept. 29, 2016) (“A team of top scientists is telling world leaders to stop congratulating themselves on the Paris Agreement to stop climate change because if more isn’t done, global temperatures will likely hit dangerous warming levels”), <http://www.bigstory.ap.org/article/58126674d35b4504b44c4010389a2258/scientists-world-likely-wont-avoid-dangerous-warming-mark>.

28. See Eva Wollenberg et al., *Reducing Emissions from Agriculture to Meet the 2°C Target*, 22 GLOBAL ENVTL. CHANGE 3859, 3859 (2016) (noting that excluding agriculture from mitigation targets will increase mitigation costs in other sectors or reduce the feasibility of meeting the 2°C goal but concluding that current mitigation strategies in the agriculture sector only have the capacity to deliver 21 to 40% of needed mitigation); ROB BAILEY, ANTONY FROGGATT & LAURA WELLESLEY, LIVESTOCK—CLIMATE CHANGE’S FORGOTTEN SECTOR: GLOBAL OPINION ON MEAT AND DAIRY CONSUMPTION, CHATHAM HOUSE 4 (2014) (noting that while new technologies and changes in livestock production practices can reduce livestock emissions, these efforts alone are insufficient to mitigate emissions to meet the 2°C goal).

through consumer education, consumer protection litigation, investor advocacy, and corporate pressure. This approach was not by choice, but driven by the fact that, outside of wildlife protection, the animal protection movement generally lacks the portfolio of strong federal statutes and regulations developed around environmental policy since the early 1970s.

The animal protection movement, deprived of both the sword and shackles of a complex regulatory scheme to protect animal interests, has by necessity deployed an alternative “three C’s” approach (consumers, corporations, and courts) with remarkable effect in a relatively short time.²⁹ While consumer and corporate tactics have already been deployed against some aspects of the climate change problem,³⁰ a renewed, collective effort by a diverse coalition of stakeholders, aimed squarely at methane emissions, might mitigate some of the dangers of climate change in short order. It could also create a broad-based and powerful coalition for future political and legislative action to codify climate emission reforms down the road.

The somewhat ambitious goal of these papers is to diversify and increase the social, political, legal, and economic leverage currently being applied to the climate change problem, prepare for the potential dismantling of existing regulatory frameworks for climate change emissions, develop ideas for bypassing regulatory and political roadblocks that have stalled climate policy for decades, and explore creative ways to mitigate some of the worst impacts of the coming decades of increasingly unavoidable climate change crisis.

29. See generally WAYNE PACELLE, *THE HUMANE ECONOMY: HOW INNOVATORS AND ENLIGHTENED CONSUMERS ARE TRANSFORMING THE LIVES OF ANIMALS* (2016); Summer M. Hallaj, *A Decent Proposal: How Animal Welfare Organizations Have Utilized Shareholder Proposals to Achieve Greater Protections for Animals*, 47 J. MARSHALL L. REV. 795, 797 (2013); David Wolfson & Mariann Sullivan, *Foxes in the Hen House: Animals, Agribusiness, and the Law: A Modern American Fable*, in ANIMAL RIGHTS: CURRENT DEBATES AND NEW DIRECTIONS 205, 224–26 (Cass R. Sunstein & Martha C. Nussbaum eds., 2004).

30. See, e.g., Organisation for Economic Co-operation and Development, *Transition to a Low-carbon Economy: Public Goals and Corporate Practices* (Nov 25, 2010); see also Jennifer JACQUET, *IS SHAME NECESSARY: NEW USES FOR AN OLD TOOL* (2015) (comparing the power and limits of consumer-guilt and corporate-shame based public interest campaign strategies, including efforts on climate change).

I. THE BASIC SCIENCE OF CLIMATE CHANGE

As discussed above, the problem of climate change is fundamentally misunderstood in most quarters of society, including among many state and federal political leaders. Virtually every relevant fact concerning climate change is disputed by someone in the roiling contentious waters of climate change public policy. Accordingly, this discussion begins with two basic assumptions. The first is that climate change is a reality that is already manifesting itself throughout the world. The second is that human activities are either causing this change, or are significantly contributing to it on a global scale. These two assertions are so well accepted within the scientific community that the arguments against them are both far-fetched and beyond the scope of this article.³¹

As Dr. Joseph Romm explains in his recent book, *Climate Change: What Everyone Needs to Know*, although “scientists have known for over a century that human-caused greenhouse gasses would warm the planet,” and “began seriously sounding the alarm about the dangers of unrestricted emissions” in the 1970s, there has been growing concern over the last several years because “many cornerstone elements of our climate began changing far faster than most scientists had projected.”³² The key problem is that current data on increasing temperature, rising sea levels, and melting ice far outpaces virtually all of the climate change models developed over the last few decades.³³

As summarized by Dr. Romm:

The Arctic region warmed up even faster than scientists expected. At the same time, the great ice sheets of Greenland and Antarctica, which contain enough water to raise sea levels ultimately 25–80 meters have begun disintegrating ‘a century ahead of schedule’ In 2014 and 2015, we learned that both ice sheets are far less stable than we realized, and they are dangerously close to tipping points that would lead to irretrievable collapse and dramatic rates of sea-level rise. In the last several decades we have experienced a spate of off-the-charts extreme weather events that

31. See, e.g., William R.L. Anderegg et al., *Expert Credibility in Climate Change*, 107 PROC. NAT’L ACAD. SCIS. 12107, 12107 (2010) (finding that 97–98% of the climate researchers most actively publishing believe climate change is human-caused and that the climate expertise and scientific prominence of researchers who are unconvinced of human-caused climate change are substantially lower than their convinced counterparts).

32. ROMM, *supra* note 26, at xv (15).

33. See *id.* at xv–xvi (15–16).

scientists had predicted decades ago—heat waves, droughts, wildfires, super-storms, and super storm surges. . . . There is an ever-expanding body of scientific literature that clearly shows that greenhouse gases are fundamentally altering the climate and sharply boosting the chances for many types of extreme weather events.³⁴

The much-discussed culprit in all of this is human-caused emissions of carbon dioxide (“CO₂”). Prior to the industrial revolution, scientists believe that total atmospheric CO₂ levels were approximately 280 parts per million (ppm).³⁵ Human activities between the mid-eighteenth century and 1970 raised this number to approximately 325 ppm.³⁶ Between 1970 and 2015, that number has jumped to over 400 ppm.³⁷ These increasing levels of CO₂ and other GHG emissions have increased warming, with 2016 having the dubious honor of being the hottest year on record, as did 2015 before it.³⁸

More than 90% of this increased heat is being absorbed into the world’s oceans, which in turn increases evaporation, which causes further heating from trapped water vapor.³⁹ Similarly, when increased temperatures, drought conditions or other extreme weather events trigger wildfires, the CO₂ released from such burning causes even more warming, which increases the frequency of extreme weather events.⁴⁰ Climate scientists call these types of additive heating cycles “amplifying feedbacks.”⁴¹ In essence, the adverse warming effects of GHG emissions take on a life of their own, feeding further warming.

Unlike other more familiar types of air and water pollution, this feedback process is exacerbated because CO₂ does not quickly dissipate from the atmosphere once carbon emissions are halted or reduced.⁴² This is perhaps the most frequently misunderstood aspect of the climate change problem. Unlike the chlorofluorocarbons that famously threatened the ozone layer in the 1980s, and

34. *Id.*

35. *Id.* at 1–2.

36. *Id.* at 10.

37. *Id.*

38. *2016 Climate Trends Continue to Break Records*, NASA, <https://www.nasa.gov/feature/goddard/2016/climate-trends-continue-to-break-records>; *Global Summary Information—December 2015*, NOAA NAT’L CTRS. ENVTL. INFO., <http://www.ncdc.noaa.gov/sotc/summary-info/global/201512>.

39. ROMM, *supra* note 26, at 6, 14.

40. *Id.* at 85.

41. *See id.* at 13.

42. *See id.* at 22.

then quickly dissipated once they were banned,⁴³ CO₂ emissions take many decades or even centuries to naturally disperse.⁴⁴ Thus, contrary to most people's understanding of the problem of climate change, simply cutting off the source of CO₂ emissions does nothing to stop the warming effect of existing atmospheric CO₂ or the cycle of amplifying feedbacks created by current CO₂ levels.

Although there is no question that, for the benefit of future generations, current CO₂ emissions levels must be significantly reduced, the available science suggests that an immediate halt of all CO₂ emissions (something that is politically and practically impossible) would not stave off the already manifesting negative effects of climate change.⁴⁵ As a scientist from the National Oceanic and Atmospheric Administration concluded back in 2009, "the climate change that takes place due to increases in carbon dioxide concentration is largely irreversible for 1,000 years after emissions stop."⁴⁶

Because of the long-lived nature of CO₂ emissions, many climate scientists now see methane emissions—the second largest source of GHGs after CO₂—as a more practical target for significant reduction over the near-term.⁴⁷ Although making up only a small percentage of the total portfolio of GHG emissions, methane is several orders of magnitude more potent as a climate warming agent than CO₂, and dissipates from the atmosphere in eight to twelve years, as opposed to the hundreds or even thousands of years required for CO₂.⁴⁸ For this reason, as discussed in the next paper in this series, methane reduction might be the only feasible climate strategy left to us after years of carbon emission neglect, and the only hope of mitigation over the next ten to twenty years.

43. See Eric Hand, *CFC Bans Pay Off as Antarctic Ozone Layer Starts to Mend*, 353 SCI. 16, 16–17 (2016) (finding ozone hole was shrinking due to declining pollutants in the atmosphere after CFCs were phased out by the Montreal Protocol).

44. ROMM, *supra* note 26, at 22.

45. See Frolicher, *supra* note 25, at 43.

46. Susan Solomon et al., *Irreversible Climate Change Due to Carbon Dioxide Emissions*, 106 PROC. NAT'L ACAD. SCI. 1704, 1704 (2009).

47. See, e.g., Frolicher, *supra* note 25; Drew Shindell et al., *Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security*, 335 SCI. 183, 183 (2012); Miklos Bankuti et al., COMPLEMENTS TO CARBON: OPPORTUNITIES FOR NEAR-TERM ACTION ON NON-CO₂ CLIMATE FORCERS 13–15 (2011).

48. Miller, *supra* note 26 at 20018; ROMM, *supra* note 26 at 81.

II. THE TENUOUS LEGAL FRAMEWORK FOR CLIMATE CHANGE EMISSIONS

Over the last several decades, the traditional domestic and international environmental command and control regulatory schemes have repeatedly failed to meaningfully address the kind of widespread, diffuse GHG emissions, feedback–forcing events, and climate change impacts described in the previous section. Because climate emissions are transboundary in both cause and effect, the primary legal norms concerning such emissions are international. The voluntary nature of international law, and the notorious difficulties of enforcing international agreements, only exacerbate the already troublesome nature of trying to regulate climate emissions.

The first significant effort to reach a meaningful international agreement to address GHG emissions was in 1992, with the U.N. Framework Convention on Climate Change at Rio de Janeiro.⁴⁹ The purpose of the agreement was to stabilize GHG emissions at a level that would avoid “dangerous anthropogenic interference with climate systems,” but the agreement did not specify what that level would be.⁵⁰ A much more significant follow up agreement executed in Kyoto, Japan in 1997 actually set mandatory emissions limits for certain countries but again failed to define what an acceptable level of GHG emissions, or resulting warming, would be.⁵¹ It was not until the 2009 agreement in Copenhagen that the parties agreed that holding warming to 2 degrees Celsius was the desired target of regulation.⁵²

However, non–uniform adoption and ratification has been a significant factor limiting the effectiveness of these international agreements over the last twenty–five years. Although nearly 200 nations have ratified the 1992 United Nations Framework Convention on Climate Change,⁵³ the much more exacting Kyoto Protocol was never ratified by the United States—the world’s leading economy

49. United Nations Framework Convention on Climate Change, June 4, 1992, 1771 U.N.T.S. 107.

50. *Id.* at art. 2.

51. *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, 2303 U.N.T.S. 162.

52. Copenhagen Accord, United Nations Climate Change Conference, para. 1, Dec. 18, 2009, FCCC/CP/2009/L.7.

53. *Status of the Ratification of the Convention*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, http://unfccc.int/essential_background/convention/status_of_ratification/items/2631.php (last visited August 8, 2016).

and one of the largest emitters of GHGs. In 2001, the Bush administration officially rejected the Protocol in its entirety.⁵⁴ The controversial and conspicuous non-participation of the United States had a devastating effect on both the agreement itself and the overall global environment for further climate negotiations. After its enactment, several ratifying countries, including Canada and Russia, subsequently announced they would no longer abide by its provisions.⁵⁵ Follow-up meetings in 2009 and 2011 also failed to produce any kind of binding commitments or ratification by the United States and other major emitting countries.⁵⁶ In many cases, and certainly for the United States, domestic political problems—including ongoing debates about whether human-caused climate change even exists—have proven to be a significant impediment to progress in the international arena.

This problem is closely related to the other fundamental problem with the Rio Convention and those that have followed—they essentially leave individual member nations with unlimited discretion when implementing measures to control emissions and in deciding whether to enforce standards. This has been one of the biggest criticisms of the 2015 Paris Agreement, which has been heralded by climate advocates and the media as a major step forward for international climate change regulation. Given the extreme hostility of the U.S. Congress to legislating on climate change, or even granting the EPA funding to study and regulate climate emissions, most experienced observers agree that little or no significant implementing legislation will be undertaken at the federal level in the United States.⁵⁷ This is a crippling defect in the 2015 agreement, in light of the United States' key role in both global GHG emissions and the international economy.⁵⁸

54. Julian Borger, *Bush Kills Global Warming Treaty*, THE GUARDIAN (Mar. 29, 2001), <https://www.theguardian.com/environment/2001/mar/29/globalwarming.usnews>.

55. Nastissia Astrasheuskaya, *Russia Will Not Cut Emissions Under Extended Kyoto Climate Pact*, REUTERS (Sept. 13, 2012), <http://www.reuters.com/article/us-russia-kyoto-idUSBRE88C0QZ20120913>; *Canada Pulls Out of Kyoto Protocol*, THE GUARDIAN (Dec. 12, 2011), <https://www.theguardian.com/environment/2011/dec/13/canada-pulls-out-kyoto-protocol>.

56. Fiona Harvey & Damian Carrington, *Durban Climate Conference Agrees Deal to Do a Deal – Now Comes the Hard Part*, THE GUARDIAN (Dec. 12, 2011), <https://www.theguardian.com/environment/2011/dec/12/durban-climate-change-conference-2011-southafrica>; Helene Cooper, *Leaders Will Delay Deals on Climate Change*, N.Y. TIMES (Nov. 14, 2009), http://www.nytimes.com/2009/11/15/world/asia/15prexy.html?_r=0.

57. Indeed, domestic legislative hostility to climate change legislation is so high that the Obama administration itself sought and obtained changes in the 2015 Paris Agreement to ensure that it would not constitute a binding treaty, and thus require ratification by the U.S. Senate. See Suzanne Goldenberg, *How US Negotiators Ensured Landmark Paris Climate Deal Was Republican-Proof*,

As for the U.S. domestic regulatory scheme for climate change, it can only be described as nascent and ineffectual—at least on the comprehensive scale required for such an existential threat. Many foreign climate advocates and scholars are shocked to discover that the United States—a nation with perhaps the most fully developed environmental laws—does not have a federal climate change statute at all. Instead, the EPA, other governmental officials, and legal advocates are forced to cobble together bits and pieces of other background environmental laws to try and address some aspects of U.S. climate emissions.⁵⁹ Much like a stranded motorist trying to fix a flat tire with electrical tape, the resulting efforts are slow, inconsistent, and prone to failure.

The most commonly deployed stopgap statute is the federal Clean Air Act (“CAA”), which authorizes the EPA to regulate emissions from stationary and mobile sources, and uses as its primary tool the designation of ambient air quality standards for various regions of the country.⁶⁰ Written years before any serious public policy discussion about climate change regulation,⁶¹ the Act is fundamentally inadequate to control diffuse, transboundary, and cumulative GHG emissions. And although the EPA initially acknowledged that it had authority to regulate CO₂ under the Act, it declined to exercise that authority for years⁶²—a

THE GUARDIAN (Dec. 13, 2015), <https://www.theguardian.com/us-news/2015/dec/13/climate-change-paris-deal-cop21-obama-administration-congress-republicans-environment>.

58. See Payam Nejat et al., *A Global Review of Energy Consumption, CO₂ Emissions and Policy in the Residential Sector (With an Overview of the Top Ten CO₂ Emitting Countries)*, 43 RENEWABLE & SUSTAINABLE ENERGY REVS. 843, 844, 850–51 (2015) (detailing U.S. energy consumption and CO₂ emissions; in both, the country is second only to China).

59. Because of the sweeping and comprehensive nature of emissions changes needed to meet international targets, this discussion focuses on federal efforts to regulate emissions. For an excellent overview of recent state level efforts, see Vicki Arroyo et al., *State Innovations on Climate Change: Reducing Emissions from Key Sectors While Preparing for the “New Normal,”* 10 HARV. L. & POL’Y REV. 601 (2016).

60. See 42 U.S.C. § 7521 (authorizing the EPA Administrator to prescribe emissions standards for new motor vehicles); *Id.* at § 7571 (authorizing the EPA Administrator—through consultation with the FAA Administrator—to prescribe emissions standards for aircraft); *Id.* at § 7411 (authorizing the EPA Administrator to prescribe emissions standards for stationary sources).

61. The Clean Air Act, enacted in 1970, “authorized the development of comprehensive federal and state regulations to limit emissions from both stationary (industrial) sources and mobile sources.” U.S. EPA, CLEAN AIR ACT OVERVIEW: EVOLUTION OF THE CLEAN AIR ACT (2016), <https://www.epa.gov/clean-air-act-overview/evolution-clean-air-act>.

62. See Memorandum from Jonathan Z. Cannon, EPA Gen. Counsel, to Carol Browner, EPA Administrator (Apr. 10, 1998), <http://www.law.umaryland.edu/environment/casebook/documents/EPACO2memo1.pdf> (“While CO₂ emissions are within the scope of EPA’s authority to regulate, the Administrator or [sic] has

position that was challenged in 1999 by way of a legal petition seeking EPA regulation of GHGs from automobiles.⁶³

The EPA's denial of that petition triggered litigation that eventually made its way to the U.S. Supreme Court, which held in *Massachusetts v. EPA* that the agency did indeed have legal authority to regulate GHG emissions as "pollutants."⁶⁴ In 2009, a full decade after the petition was submitted, the EPA finally designated six major global warming gases as a threat to public health and welfare.⁶⁵ The 2009 "endangerment" finding designated CO₂, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, and found that emissions of these gases from motor vehicles present a threat to public health. But the EPA did not propose or take any specific action concerning emissions of these GHG pollutants in that finding.⁶⁶

The 2009 finding set off a protracted series of regulations and lawsuits that have rendered EPA regulation of GHG emissions an almost impenetrable morass for all but the most seasoned air pollution legal experts. A full explication of this checkered regulatory history is beyond the scope of this paper,⁶⁷ but the fundamental problem with the entire effort is that the CAA was never designed to shoulder the burden of climate change emissions control. The combination of the decision in *Massachusetts v. EPA* and the 2009 endangerment finding left EPA with a massive regulatory overbreadth problem—with approximately six million commercial and private sources of emissions falling within the strict letter of the CAA.⁶⁸

made no determination to date to exercise that authority under the specific criteria provide [sic] under any provision of the Act.”).

63. International Center for Technology Assessment et al., Petition for Rulemaking and Collateral Relief Seeking the Regulation of Greenhouse Gas Emissions From New Motor Vehicles Under § 202 of the Clean Air Act (Oct. 20, 1999), http://www.ciel.org/wp-content/uploads/2015/05/greenhouse_petition_EPA.pdf.

64. *Massachusetts v. EPA*, 549 U.S. 497, 532 (2007).

65. See Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496, 66,501 (Dec. 15, 2009) (codified at 40 C.F.R. ch. 1).

66. *Id.* at 66,497–99.

67. For a comprehensive overview of U.S. laws and regulations concerning climate change, see MICHAL NACHMANY ET AL., THE 2015 GLOBAL CLIMATE LEGISLATION STUDY: A REVIEW OF CLIMATE CHANGE LEGISLATION IN 99 COUNTRIES (2015).

68. See Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule, 75 Fed. Reg. 31,514, 31,536 (June 3, 2010) [hereinafter Tailoring Rule] (“Based on our GHG threshold data analysis, we estimated that approximately 6 million sources would become subject to title V. Compared to the 14,700 title V permits currently issued . . .”).

The EPA responded to this six million emitter problem with a series of proposed regulatory exclusions, delays, and phase-in proposals that have only made an already complicated regulatory scheme even more difficult to understand or legally justify in the numerous cases where EPA's efforts to prioritize various GHG emission sources have been challenged in court.⁶⁹ The most controversial of these rules was the so-called "tailoring rule"—a euphemistic name for the agency's attempt to carve out a number of wholesale exemptions from the CAA of questionable legal provenance.⁷⁰ The tailoring rule and other regulatory machinations have left EPA with a confused patchwork of GHG emission regulations that do not appear to follow any science-based logic. For example, the agency issued multiple sets of regulations for GHG emissions from conventional cars and trucks⁷¹ but refused to do anything to address similar emissions from off-road vehicles and marine vessels because regulating these non-highway emissions would somehow "detract from addressing more pressing environmental issues."⁷²

Likewise, although the EPA has recently recognized the importance of regulating methane emissions due to their high warming potency, short-lived nature, and resulting high potential for climate warming mitigation,⁷³ the agency's approach has been similarly inconsistent. Thus, in the fall of 2015, the EPA

69. See Howard Kenison & Katherine A. Roek, *EPA's Evolving Regulation of Greenhouse Gases*, 40 COLO. LAW. 53, 55 (2011) (outlining EPA regulation of greenhouse gases under the Clean Air Act and judicial challenges to EPA actions following the Supreme Court's decision in *Massachusetts v. EPA*).

70. See Tailoring Rule, *supra* note 69, at 31,596 ("This final rule will provide relief from title V permitting to over 6 million sources of GHG in this country.").

71. Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62,624 (Dec. 12, 2012); see 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62,624 (Oct. 15, 2012); Greenhouse Gas Emission Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles, 76 Fed. Reg. 57,106 (Sept. 15, 2011).

72. U.S. EPA, Memorandum in Response to Petitions Regarding Greenhouse Gas and Other Emissions from Marine Vessels and Nonroad Engines and Vehicles 4, http://www.eenews.net/assets/2012/06/18/document_pm_06.pdf

73. See U.S. EPA, *EPA Proposes New Commonsense Measures to Cut Methane Emissions from the Oil and Gas Sector/Proposal Cuts GHG Emissions, Reduces Smog-Forming Air Pollution and Provides Certainty for Industry* (2015), <https://www.epa.gov/newsreleases/epa-proposes-new-commonsense-measures-cut-methane-emissions-oil-and-gas-sectorproposal>; see also Saunio, *supra* note 27, at 120207 ("Because of methane's high global warming potential and short lifetime in the atmosphere compared to CO₂, its mitigation offers the possibility to slow climate change efficiently in a shorter time horizon.").

announced with much fanfare the release of regulations to cut methane emissions from natural gas production and transportation, a move that was widely commended by environmentalists for cracking down on “the second leading source of methane emissions in the U.S.”⁷⁴

At the same time, the agency said nothing about the *number one source* of such emissions in the U.S.—animal and plant agriculture—nor did the agency offer any explanation for why it was not proposing to take any action to regulate such emissions.⁷⁵ After numerous commenters and the media noted the conspicuous absence of any discussion or action on the number one source of methane emissions, the EPA revised its official website methane “pie chart” of emission sources to nudge oil and gas methane emissions up a few percentage points to first place and drop agricultural methane emissions down to a close second.⁷⁶ By the time the final rule was issued in May of 2016, the agency was now addressing the number *one* source of methane pollution.⁷⁷

In fairness, the EPA—like all federal agencies—has to operate within the realm of the politically possible and is well aware of both the major role agricultural emissions play in climate change and the political firestorm that would result from any move to regulate such emissions under the CAA. However, the EPA’s piecemeal approach to methane regulation feeds lingering doubts about the legitimacy and urgency of climate change regulation among climate change skeptics, and among advocates about the EPA’s capacity to take the kind of comprehensive action necessary to avoid major climate change impacts in the coming decades. Indeed, at every step of the way, the agency’s actions have been delayed and frustrated by a fusillade of lawsuits and an ever-present threat of congressional retaliation revoking all climate change authority. When the EPA

74. See, e.g., Patrick Parenteau, *Status of Methane Regulation in the United States*, SABIN CTR. CLIMATE CHANGE L. (Feb. 22 2016); see also Miller, *supra* note 26 (noting that “The U.S. Environmental Protection Agency estimates the principal anthropogenic sources [of methane] in the United States to be (in order of importance): (i) livestock (enteric fermentation and manure management), (ii) natural gas production and distribution, (iii) landfills, and (iv) coal mining”).

75. See Oil and Natural Gas Sector: Emission Standards for New and Modified Sources, 181 Fed. Reg. 56,593 (proposed Sept. 18 2015) (to be codified at 40 C.F.R. pt. 60).

76. See U.S. EPA, *Greenhouse Gas Emissions: Overview of Greenhouse Gases: Methane* (2016), <https://www.epa.gov/ghgemissions/overview-greenhouse-gases#methane>.

77. Compare U.S. EPA, *supra* note 76, at 56,606–07 (Table 2 showing enteric fermentation and manure management as the largest methane source in 1990, 2005, and currently), with Oil and Natural Gas Sector: Emission Standards for New and Modified Sources, 81 Fed. Reg. 35,824, 35,828 (June 3, 2016) (codified at 40 C.F.R. pt. 60) (Table 2 revising figures for 1990, 2005, and currently to make oil and gas the largest source of methane emissions in the U.S.).

has attempted a coherent and comprehensive approach to a particular GHG emission sector—like the Clean Power Plan—it set off a legal “civil war” between dozens of state Attorneys General⁷⁸ and a swift and unprecedented injunction issued from the U.S. Supreme Court itself.⁷⁹ In short, well-intentioned efforts to utilize the CAA as a means to regulate GHG emissions have resulted in a confusing, piecemeal, and non-comprehensive patchwork of regulations that could certainly help to stabilize emission levels in some sectors, but entirely ignores others, and remains extremely fragile and critically imperiled by changing political winds.

These fundamental structural problems with both the domestic and international regulatory scheme for climate emissions are discussed further in the next paper in this series, as they provide the impetus for the need to redirect climate campaigners and academics away from their continued reliance on statutory and regulatory methods that are unlikely to ever materialize, much less have a significant impact within the short timeframe needed to mitigate the most serious impacts of global climate change.

III. THE INTERSECTIONAL AND DISCRIMINATORY IMPACTS OF CLIMATE CHANGE

As discussed above, the focus of this paper is the urgent need for those fighting to control climate change emissions to eradicate the persistent misconception that climate change is an environmental special interest issue, divorced from other more pressing social issues like poverty, racism, war, and the plight of people displaced by these evils. Redefining climate change as an overarching social justice issue that transcends its traditional status as an esoteric environmental theory is absolutely essential to any effort to build an effective and unified agenda to address climate emissions.

In order to precipitate this broader view of climate policy, climate advocates must look inward first, reexamine their own biases and assumptions, and rethink the traditional focus of climate change advocacy over the last two decades. The starting place for this journey is a fresh look at the likely scope and impact of damage from climate-related harms to the most vulnerable elements of our

78. Kendall, *supra* note 19.

79. Denniston, *supra* note 20.

society, with a focus on the least talked about and indeed often invisible victims of climate change.

For purposes of this discussion, the various risks of unmitigated climate change have been categorized in roughly the same manner the public interest legal community has organized itself. In many cases, the traditional definitions of where one public interest field ends and another begins are at best arbitrary, and serve to obscure the intersectional nature of climate change threats. But before turning to an exploration of the intersectional impacts of climate change on those various self-defined public interest “fields,” an introduction to the discriminatory impacts of climate change upon the most vulnerable elements of society is warranted.

There is no better preliminary example of these disproportional impacts than the experience of Hurricane Katrina. A stark example of what a major climate disaster might look like, the experience of Hurricane Katrina is demonstrative of the troubling demographics and likely distribution of climate change impacts within our society.

In 2008, researchers analyzed the demographics of Hurricane Katrina and concluded the distribution of the disaster’s impacts had little to do with environmental conservation or meteorology and everything to do with the intersectional impacts of poverty and race.⁸⁰ After mapping deaths across the city, the study concluded that whether a New Orleans resident could afford an automobile was the number one indicator of death during the storm.⁸¹ The poor, unable to flee the disaster, had no choice but to stay and risk death as the water rose.⁸² The second leading indicator, unsurprisingly, was race. The study concluded that “blacks were significantly more likely to be storm victims than whites in all age groups.”⁸³ The elderly were also identified as disproportionately victimized by the storm, again because of their lack of mobility.⁸⁴

In short, even a cursory look at the demographics of Hurricane Katrina shows that virtually all of the serious impacts of the storm accrued to the poor and

80. Joan Brunkard, Gonza Namulanda & Raoult Ratard, *Hurricane Katrina Deaths, Louisiana, 2005*, AMERICAN MEDICAL ASSOCIATION: DISASTER MEDICINE AND PUBLIC HEALTH PREPAREDNESS 1 (Aug. 28, 2008); see also Anna Kaijser & Annica Kronsell, *Climate Change Through the Lens of Intersectionality*, 3 ENVIRONMENTAL POLITICS 417, 421–22 (2014).

81. Brunkard, Namulanda & Ratard at 6.

82. *Id.*

83. *Id.* at 7.

84. *Id.* at 6.

people of color, and not the upper–middle class white residents who make up the vast majority of the environmental movement and, by extension, are the most active in the battle against climate change.⁸⁵ This disconnect between those most at risk from climate–related harms and those most active and supportive of aggressive action to curb greenhouse gas emissions is a major problem for climate campaigners, as well as the millions of people who are most likely to experience climate–caused harm. It is a problem because it is not just the potential victims who remain insufficiently engaged in addressing the looming risk, but the public interest groups that are working for their benefit and advancement as well.

There is another troubling lesson lurking within the Katrina data, and that is the startling degree to which state, federal, and private emergency response agencies were totally unprepared for the humane crisis that crippled three states in the wake of Hurricane Katrina. I use “humane” rather than “humanitarian” with intent in this context to encompass both human suffering and animal suffering, since in no sector were governmental and private charitable organizations caught more unprepared than with regard to the problem of companion animals.

Indeed, a correlation among the Katrina fatalities not mentioned in the 2008 study was the presence of companion animals in the home. As many as 250,000 companion animals perished or were displaced during this single hurricane event.⁸⁶ Because at that time federal and state disaster shelters and evacuation plans did not allow families to bring their pets, many who could have fled the rising waters stayed and died as a result.⁸⁷ As discussed in more detail below, these correlations and interconnected cause and effect relationships between traditionally distinct public interest causes—the plight of the poor, the humane treatment of animals, etc.—are everywhere once you start deconstructing the myth of climate change as a narrow environmental concern.

To be clear, it would not be irrational to hope that climate change was merely an environmental issue—a narrow special interest concern of the white upper–middle class, who can afford the luxury of their anxiety over the fate of the world

85. Marcelo Bonta & Charles Jordan, *Diversifying the American Environmental Movement*, in *DIVERSITY AND THE FUTURE OF THE ENVIRONMENTAL MOVEMENT* 13, 14 (E. Enderle ed., 2007).

86. Matt Bershadker, *The Lessons in Hurricane Katrina’s Legacy*, AM. SOC’Y FOR THE PREVENTION OF CRUELTY TO ANIMALS BLOG (Aug. 27, 2015); FED. EMERGENCY MGMT. AGENCY, *PREPARING FOR A DISASTER: PLANNING FOR PETS AND LIVESTOCK* (2004) [hereinafter *PREPARING FOR A DISASTER*]; FED. EMERGENCY MGMT. AGENCY, *REVIEWING LOUISIANA ANIMAL EVACUATION AND RESCUE* (2005).

87. Bershadker, *supra* note 86.

in 50 or 100 years. Unfortunately, as discussed herein, the actual truth about what is already known about the front-line victims of climate change is exactly the opposite. This should be of great concern to virtually every public interest cause in the world today because the impacts are already here.

In order to better understand the grave dangers climate change presents to a multitude of social causes and why collective action is urgently required, it is necessary to explore the stark reality of what climate change means for several of the major public interest causes. This summary amply highlights how little the impacts of climate change will be felt among the small number of affluent white constituents of the environmental movement as compared to other public interest constituencies, the inherently intersectional nature of the problem, and the urgent need for a collective interdisciplinary response.

A. POVERTY, PUBLIC HEALTH, AND CLIMATE CHANGE

It is impossible to have any meaningful discussion about the victims of climate change without noting how disproportionately the poor will suffer a calamity they have little role in creating.⁸⁸ On average, an individual in the top 1% of the world's population releases 175 times more carbon each year than a person living in the bottom 10%.⁸⁹ At the same time, the collective top 10% of the world financially emit more than half of all global GHG emissions, whereas the bottom 50% collectively emit just 10% of such emissions.⁹⁰ To make matters worse, those countries in the lower rungs of world wealth are working overtime to pull their people up the wealth ladder and, as a result, have the highest projections of GHG emission increases between now and 2050.

The fundamental inequity of developed countries with high levels of wealth and high but relatively stable levels of emissions trying to limit rapidly expanding emissions levels from developing countries with low wealth has stymied

88. Kirstin Dow et al., *Exploring the Social Justice Implications of Adaptation and Vulnerability*, in FAIRNESS IN ADAPTATION TO CLIMATE CHANGE 79, 82 (W. Neil Adger et al. eds., 2006) (“[I]t is likely that those who have contributed most to climate change are likely to suffer least from its effects, and that those who are most vulnerable to future effects and have contributed the least are likely to suffer the most.”).

89. OXFAM, EXTREME CARBON INEQUALITY: WHY THE PARIS CLIMATE DEAL MUST PUT THE POOREST, LOWEST EMITTING AND MOST VULNERABLE PEOPLE FIRST 4 (2015).

90. Francisco H.G. Ferreira et al., *A Global Count of the Extreme Poor in 2012: Data Issues, Methodology and Initial Results*, WORLD BANK GROUP 2 (2015), http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2015/10/14/090224b083144b10/2_0/Rendered/PDF/A0global0count00and0initial0results.pdf.

international climate talks for decades. Caught in the middle of this conflict—as they are in all global conflicts—are the 897 million people in the world living in extreme poverty, which the World Bank describes as those living on less than \$2 a day.⁹¹

There are many reasons why the world’s poor are going to take the brunt of the impacts of climate change, but one of the biggest is the disproportionate number of economically disadvantaged people living only slightly above current sea levels. As discussed in more detail below in reference to climate change and refugees, the unique risk facing this segment of the world’s poor is obvious to anyone with even a passing understanding of climate science. A 2007 study on the impacts of climate change on low elevation human populations found that there are approximately 247 million people in low-income countries living in coastal areas less than ten meters above sea level.⁹² One hundred million of these at-risk people live in urban areas.⁹³

Although more than 600 million people live on land that is less than ten meters above sea level,⁹⁴ the difference between the wealthy and the poor—as we saw in the case of Hurricane Katrina—is that the poor have little or no capacity to escape rising waters or extreme weather events. This problem is exacerbated because low-wealth countries have less infrastructure and resources to deal with disasters—creating a devastating one-two punch of no individual capacity for escape and no prospects for government rescue. That the people of New Orleans experienced this exact knock-out blow while living in the wealthiest country in the world should be a piercing climate change wake-up call for any public interest organization that advocates for the interests of the economically disadvantaged, either internationally or here in the United States.

The staggering and disproportionate impacts of climate change on the poor are highlighted in a recent World Bank Report on “Managing the Impacts of Climate Change on Poverty” (“World Bank Report”).⁹⁵ This report also dispelled the common misperception in the United States that rising sea levels and severe storms are a problem primarily for wealthy beachfront homeowners, who should

91. *Id.* at 36.

92. Gordon McGranahan et al., *The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones*, 19 ENV’T & URBANIZATION 17, 24 (2007).

93. *Id.*

94. *Id.* at 22.

95. See generally Stephane Hallegatte et al., *Shock Waves: Managing the Impacts of Climate Change on Poverty*, WORLD BANK GROUP (2016).

not have built their homes in flood prone areas.⁹⁶ In the World Bank Report, the authors note that “in absolute terms, wealthier people lose a larger amount of assets or income because of a flood or storm, which is expected as they have more assets and higher incomes.”⁹⁷ However, the report continues, “in relative terms, poor people always lose more than non-poor people from floods and storms. It is these relative losses, rather than absolute numbers, that matter more for livelihoods and welfare.”⁹⁸

The World Bank Report notes several reasons for this. First, the poor have less of their wealth secured in non-material assets, and thus unlike the wealthy, they are not able to “spatially diversify” their assets in financial institutions that are protected from natural hazards.⁹⁹ Second, natural disasters wreak havoc upon public services and infrastructure, and although all people to some extent “depend on electricity, working roads, and running water to earn a living, poor people tend to be less able to protect themselves from the consequences of disruptions in infrastructure services.”¹⁰⁰ This is particularly true for those dependent on some level of governmental financial, housing, or food assistance.

The third factor in the World Bank Report is perhaps the most important—the cyclical effect of natural disasters and the creation and perpetuation of poverty. A climate change induced increase in natural disasters “may create a negative feedback loop, in which poor households have no choice but to settle in at-risk zones (with cheaper rents) and as a result face increased challenges to escaping poverty.”¹⁰¹ Thus, as discussed above, much in the same way increased warming from GHG emissions can cause negative feedback loops that increase other sources of GHG emissions,¹⁰² the impacts of warming in terms of rising waters

96. *Id.* at 91.

97. *Id.*

98. *Id.*

99. *Id.* at 92.

100. *Id.* at 93.

101. *Id.* at 80 (“Natural disasters are thus one of the critical channels through which climate-sensitive events already affect, and can increasingly affect, the ability of poor people to escape poverty. An increase in the frequency or intensity of natural disasters is expected because of climate change—which is likely to push more people into poverty and increase poverty headcounts.”).

102. *See* ROMM, *supra* note 26, at 13–14; *see also* ROMM, *supra* text accompanying notes 38–40.

and storms can create feedback loops that expand and perpetuate the cycle of poverty.¹⁰³

If all of this were not enough to re-define climate change as a core poverty and public health issue, there are other troubling impacts in store for the world's most vulnerable populations. There is now widespread agreement that the impacts of climate change will significantly disrupt the supply of food and water, and pose a significant risk to global food security.¹⁰⁴ As with other climate change impacts, this lack of food and water security will hit poor and underdeveloped countries particularly hard. Nearly half the world's population already lacks access to adequate water and sanitation, and the effects of climate change are projected to "produce reduced stream flow and increased droughts in many of these areas, particularly Central Asia, the Mediterranean, and southern Africa."¹⁰⁵

Changes in weather patterns and precipitation are projected to reduce both surface water and groundwater availability and create added competition for water.¹⁰⁶ As snowpack levels are reduced by warming and glacial melting intensifies, these already problematic shortages of water "will figure prominently in low human development traps, eroding the ecological resources on which the poor depend, and restricting options for employment and production."¹⁰⁷

These same patterns of extreme weather and water shortages will also negate and roll back decades of advances in food security around the globe. Here again, the impacts will not be equally distributed, with food shortages and increased prices "concentrated in a number of developing countries where impacts will interact with other environmental stresses and chronic socioeconomic vulnerabilities."¹⁰⁸ Particularly hard hit will be poor communities dependent on a

103. Climate change also has a significant macro-level impact on economic growth and development, with most experts agreeing that for every one degree rise in temperature, municipal per capita income declines between 1.2–1.9%. Melissa Dell et al., *Temperature and Income: Reconciling New Cross-Sectional and Panel Estimates*, 99 AM. ECON. REV. 198, 198 (2009); John K. Horowitz, *The Income-Temperature Relationship in a Cross-Section of Countries and its Implications for Predicting the Effects of Global Warming*, 44 ENVTL. & RESOURCE ECON. 475, 489 (2009).

104. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: SYNTHESIS REPORT 13 (2014) [hereinafter IPCC REPORT].

105. Dow et al., *supra* note 88, at 87.

106. IPCC REPORT, *supra* note 104, at 13.

107. KEVIN WATKINS ET AL., FIGHTING CLIMATE CHANGE: HUMAN SOLIDARITY IN A DIVIDED WORLD, HUMAN DEVELOPMENT REPORT 2007/2008 1, 94–95 (2007).

108. Dow et al., *supra* note 88, at 88; Hallegatte et al., *supra* note 95, at 51 ("Climate-induced yield reductions are not homogenous. Climate change will benefit some cold regions in the short

few key crops, which may or may not continue to be viable as weather and precipitation patterns shift due to climate change.¹⁰⁹

Increasing scarcity of food and skyrocketing food prices are particularly alarming for these at-risk communities, as poor households in developing countries spend between 40% and 60% of their total income on food and drink, in comparison to the less than 25% figure for wealthier households.¹¹⁰ Poor households are also “more likely to reduce food consumption in the face of higher prices, with a 10% increase in food price levels translating into a reduction in daily food intake by 301 kilojoules (72 kilocalories) in low-income countries.”¹¹¹ As natural disasters become more commonplace, the resulting reduction in food intake will increase the incidence of malnutrition, “stunting,” and other severe public health problems.¹¹² According to the World Bank Report, more than seven million children could suffer stunting within the next 15 years.¹¹³ These children, as well as their undernourished parents, will have significantly decreased resistance to a number of other already existing threats, including malaria.¹¹⁴ A global temperature increase of just 2 to 3 degrees Celsius (now considered a low estimate) could claim 150 million new victims in Africa alone.¹¹⁵

Adding up the sum total of this bleak and incomplete look at the major impacts of climate change upon the most economically vulnerable elements of society, public health and poverty advocates are facing a conservative estimate of an additional approximated 240,000 deaths due to climate change in the year

run, but these regions are relatively wealthy. In contrast, it will hit other regions especially hard, particularly the poorest ones.”).

109. Hallegatte et al., *supra* note 95, at 51 (“Climate change could even make agricultural areas unsuitable for cultivation of key crops, resulting in large economic impacts for poor economies that are highly dependent on a few agricultural commodities.”).

110. *Id.* at 56.

111. *Id.* at 57.

112. *Id.* at 123 (“Chronic undernutrition, or stunting, is defined as a very low weight for height (below $-3z$ scores of the median WHO growth standards), whereby children are smaller and shorter but appear normal.”).

113. *Id.* at 124.

114. *Id.* at 117 (“A large share of the deaths [from malaria] occurs among poor and vulnerable communities living in rural areas, with limited access to health facilities.”).

115. *Id.* at 118 (“At the global level, increases of 2°C or 3°C could raise the number of people at risk for malaria by up to 5 percent—affecting more than 150 million people. In Africa, malaria could increase by 5 to 7 percent among populations at risk in higher altitudes due to rising temperature, possibly increasing the number of cases by up to 28 percent.”).

2030.¹¹⁶ Furthermore, 250,000 additional deaths *per year* are expected between 2030 and 2050 as a result of climate change.¹¹⁷ This estimate does not include any loss of life from conflict and war driven by the effects of climate change—a figure that could dwarf the estimates of direct loss of life.¹¹⁸

In this regard the Syrian civil war—discussed in more detail below in reference to climate change and refugees—provides a troubling example of the potential loss of life when climate change triggers or helps trigger armed conflicts. Although it was fueled by a number of factors, many observers now agree that years of extreme drought in an area that had long experienced conflicts over access to water resources was a major factor in setting off a five-year civil war that has claimed 500,000 lives and displaced nearly 5,000,000 refugees.¹¹⁹ The Syria example is but a single war, in a relatively confined space, in response to a single drought.

The danger of climate change-based armed conflict proliferating throughout the world is so great that the U.S. Department of Defense released a report in 2014 concluding that climate change will “intensify the challenges of global instability, hunger, poverty, and conflict,” cause “food and water shortages, pandemic disease, disputes over refugees and resources, and destruction by natural disasters in regions across the globe,” and “poses immediate risks to U.S. national security.”¹²⁰ The suffering and death triggered by those conflicts, like all such conflicts, will fall disproportionately on the world’s poor—that is, the people who contributed the least to GHG emissions on a per capita basis.¹²¹ This should

116. WORLD HEALTH ORGANIZATION, QUANTITATIVE RISK ASSESSMENT OF THE EFFECTS OF CLIMATE CHANGE ON SELECTED CAUSES OF DEATH, 2030S AND 2050S 6–7 (2014) (estimating that an additional 95,000 people could die of undernutrition, an additional 60,000 people could die of malaria, and an additional 48,000 could die of diarrheal disease as a result of climate change).

117. *Id.* at 13.

118. See Marshall B. Burke et al., *Warming Increases the Risk of Civil War In Africa*, 106 PROC. NAT. ACAD. SCI. 20670, 20670 (2009) (conducting a “comprehensive examination of the potential impact of global climate change on armed conflict in sub-Saharan Africa” and finding “a roughly 54% increase in armed conflict incidence by 2030, or an additional 393,000 battle deaths”).

119. Ian Black, *Report on Syria Conflict Finds 11.5% of Population Killed or Injured*, GUARDIAN (Feb. 11, 2016), <http://www.theguardian.com/world/2016/feb/11/report-on-syria-conflict-finds-115-of-population-killed-or-injured>; U.N. OFFICE FOR THE COORDINATION OF HUMANITARIAN AFFAIRS, SYRIA CRISIS: REGIONAL OVERVIEW, <http://www.unocha.org/syrian-arab-republic/syria-country-profile/about-crisis> (last visited Jan. 21, 2017).

120. U.S. DEP’T OF DEFENSE, 2014 CLIMATE CHANGE ADAPTATION ROADMAP FORWARD 1 (2014).

121. See Dow et al., *supra* note 88, at 82.

be of great concern for anyone working to address poverty, hunger, public health, or any other basic human rights issue in the United States or abroad.

B. RACE AND CLIMATE CHANGE

Based on the foregoing discussion, it is not surprising that, on a worldwide basis, people of color also suffer the effects of climate change disproportionately, just as they disproportionately suffer the effects of war, poverty, and other social ills. As discussed above, the experience of Hurricane Katrina dramatically demonstrated the disparate impacts of natural disasters upon African-Americans. For purposes of this discussion, race-based climate change impacts will be limited to people of color in the United States.¹²²

As is the case with the economically disadvantaged, people of color in the United States contribute less to GHG emissions but will suffer more from the impact of those emissions. According to one study, “African Americans are far less responsible for global warming pollution than non-Hispanic whites. This includes both direct emissions (those that come from a household’s own purchase of fossil fuels and electricity), and indirect emissions (from the use of fuels to produce goods and services consumed by the household).”¹²³ The contrast in emissions levels between white and non-white Americans is significant, with African Americans emitting less than only 9% of total U.S. emissions and white Americans delivering a whopping 76% of the total.¹²⁴ Although some of this discrepancy is due to differing population numbers¹²⁵ as well as economic factors discussed in the previous section, the same study found that “African Americans

122. An exploration of the role of race and climate change on a global basis is far too complex a topic for this work. For an exploration of these issues, *see generally* PHOEBE GODFREY & DENISE TORRES, SYSTEMIC CRISES OF GLOBAL CLIMATE CHANGE: INTERSECTIONS OF RACE, CLASS AND GENDER (2016).

123. J. ANDREW HOERNER & NIA ROBINSON, A CLIMATE OF CHANGE: AFRICAN AMERICANS, GLOBAL WARMING, AND A JUST CLIMATE POLICY FOR THE U.S. 6 (2008), <http://www.reimaginerpe.org/files/climateofchange-2.pdf>.

124. *Id.*

125. U.S. GLOBAL CHANGE RESEARCH PROGRAM, THE IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH IN THE UNITED STATES: A SCIENTIFIC ASSESSMENT 252 (2016), https://s3.amazonaws.com/climatehealth2016/low/ClimateHealth2016_09_Populations_small.pdf (“Race is an important factor in vulnerability to climate-related stress, but it can be difficult to isolate the role of race from other related socioeconomic and geographic factors.”).

are less responsible for global warming with average household emissions of greenhouse gases that are nearly 20% lower than that of non-Hispanic whites.”¹²⁶

In return for this significantly smaller GHG emissions footprint, non-white Americans are already suffering a much larger share of climate change related impacts, which will only expand in the future. This will not come as a surprise to anyone familiar with the growing environmental justice movement in America. Even without the added burden of climate change, people of color are already disproportionately impacted by environmental hazards. These risks are well-documented in other sources, but a few key facts are worth noting. First is “an estimated 71% of African Americans live in counties in violation of federal air pollution standards, as compared to 58% of the non-Hispanic white population.”¹²⁷

Even more troubling is the statistic that 78% of African Americans live within thirty miles of a coal burning power plant, in comparison to just over half of white Americans.¹²⁸ The net result is that people of color are subject to “both disproportionate exposures for persons living in urban areas as well as higher prevalence of underlying diseases, such as asthma and COPD [Chronic Obstructive Pulmonary Disease].”¹²⁹ Asthma mortality is three times higher among African Americans as compared to white Americans.¹³⁰ Similar disparities exist within Latino communities.¹³¹

Lest there be any confusion, these disparities are not simply because people of color are more likely to have limited economic means. As explained by Professor Michael Ash, a leading expert on environmental justice,

126. HOERNER & ROBINSON, *supra* note 123, at 5.

127. *Id.* at 12.

128. *Id.*

129. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 125, at 253.

130. *Id.* These race-related disparate impacts are not limited to African Americans. *See id.* (“[A]n overwhelming 72 percent of the Hispanic/Latino population within the U.S. lives in an area that is not compliant with federal air pollution standards. This alarming number indicates that Hispanics/Latinos are at a higher risk for respiratory diseases associated with air pollutants”).

131. *See* CLEAN AIR TASKFORCE, LATINO COMMUNITIES AT RISK 1–2 (2016) (noting that “more than 1.81 million Latinos live within a half mile of existing oil and gas facilities,” and that such communities “face an elevated risk of cancer due to air toxics emissions”); Jennifer Velez, *Latinos in America Are Far More Likely Than the Average Citizen to Breathe Polluted Air*, MOTHER JONES (Oct. 6, 2016), <http://www.motherjones.com/environment/2016/09/latino-communities-polluted-air-ozone-report>.

Just as income matters independently of race, race matters independently of income. It is not the case that people of color simply happen to be poorer or live in industrial neighborhoods with lower property values. Multivariate studies—studies that test statistically for effects of race and ethnicity while holding income and other factors constant—have demonstrated that significant racial disparities in exposure persist across all bands of family income.¹³²

These disparities are expected to expand in both scope and impact as the effects of climate change continue to materialize over the next decades with the major effects being felt in terms of extreme heat events, hurricanes and other storms, reduced food security, and inadequate consideration in ongoing government planning efforts concerning climate change impact response.

The ongoing increase in both frequency and severity of extreme heat wave events should alarm anyone concerned about the ill-effects of our society falling disproportionately upon people of color. In 2016, the Obama administration released a report warning that, within the next 15 years, the total number of heat-related deaths in the United States could reach 11,000 per year.¹³³ Thus, deaths from extreme heat would surpass the scourge of gun violence, which currently claims about 10,000 lives per year, and yet has a public policy constituency and media presence an order of magnitude above climate change.¹³⁴ This prediction is not at all fanciful or unreasonable, given that more than 2,500 people died in a matter of a few months in the Indian heat wave of 2015.¹³⁵

Here again, the risks associated with such heat waves are falling primarily on people of color, who are more likely to reside in urban areas that suffer “heat island” effects, and “have limited adaptive capacity due to a lack of adequately insulated housing, inability to afford or to use air conditioning, inadequate access

132. MICHAEL ASH ET AL., JUSTICE IN THE AIR: TRACKING TOXIC POLLUTION FROM AMERICA’S INDUSTRIES AND COMPANIES TO OUR STATES, CITIES, AND NEIGHBORHOODS 8 (2009), http://dornsife.usc.edu/assets/sites/242/docs/justice_in_the_air_web.pdf.

133. THE WHITE HOUSE: OFFICE OF THE PRESS SECRETARY, FACT SHEET: WHAT CLIMATE CHANGE MEANS FOR YOUR HEALTH AND FAMILY (2016), <https://www.whitehouse.gov/the-press-office/2016/04/04/fact-sheet-what-climate-change-means-your-health-and-family>.

134. U.S. DEP’T HEALTH & HUM. SERV., DEATHS: FINAL FOR 2013, 64 NATIONAL VITAL STATISTICS REPORT 10, 84 (2016).

135. Reuters, *India Heatwave: Death Toll Passes 2,500 as Victim Families Fight for Compensation*, TELEGRAPH (June 2, 2015), <http://www.telegraph.co.uk/news/worldnews/asia/india/11645731/India-heatwave-death-toll-passes-2500-as-victim-families-fight-for-compensation.html>.

to public shelters such as cooling centers, and inadequate access to both routine and emergency health care.”¹³⁶ Several studies have found that African Americans are at increased risk of death during heat waves.¹³⁷ These increased risks are not unique to African Americans, as Mexican and Central American immigrants in California and the Southwest United States are clustered within the construction and agricultural workforce and thus also disproportionately vulnerable to heat-related deaths. A study of the 2006 heat wave in California found that nearly half of the agricultural workers who died due to heat-associated complications were of Mexican or Central American origin and that three-quarters of those deaths were adults under 50—a group that is not generally considered at-risk for heat stroke.¹³⁸ The study concluded that “as heat-wave incidence and intensity increases with climate change, these disparities will persist, if not increase.”¹³⁹

People of color are also at increased risk from the impacts of hurricanes and other extreme weather events. As is the case with economically disadvantaged populations globally, African Americans are geographically clustered directly in the line of fire of increasingly severe weather events. For example, “the states most at risk from Atlantic hurricanes are located on the Gulf and Atlantic coasts, and six of these states—Mississippi, Louisiana, Georgia, Maryland, South Carolina, and Alabama—have the highest percentage of African Americans in the U.S.”¹⁴⁰ This increased risk is similar to that facing low-income communities around the world, but here again the research suggests that race, uncoupled from a correlation with lower economic status, is a causal factor on its own. Thus, in an extensive synthesized review of disaster research spanning decades, the authors found that “minority citizens experienced different consequences as a result of

136. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 125, at 252.

137. *See, e.g.*, Rupa Basu & Bart D. Ostro, *A Multicounty Analysis Identifying the Populations Vulnerable to Mortality Associated with High Ambient Temperature in California* 168 AM. J. EPIDEMIOLOGY 632, 636 (2008); HOERNER & ROBINSON, *supra* note 123, at 11.

138. RACHEL MORELLO-FROSH ET AL., THE CLIMATE GAP: INEQUALITIES IN HOW CLIMATE CHANGE HURTS AMERICANS & HOW TO CLOSE THE GAP 11 (2009), https://dornsife.usc.edu/assets/sites/242/docs/The_Climate_Gap_Full_Report_FINAL.pdf. Here again, economic factors clearly play a role in the disproportionate impact. *See id.* (“The socioeconomic status of predominantly Mexican and Central American immigrants who come to California to work in the agricultural and construction sectors makes them particularly vulnerable because of the cumulative impacts of their long workdays under strenuous conditions, limited capacity to protect their rights, and exposure to chemicals such as pesticides.”).

139. *Id.* at 15.

140. HOERNER & ROBINSON, *supra* note 123, at 10.

natural disasters than non–minority ones. Red Cross fatality counts indicated that disaster–connected deaths were disproportionately high among ethnic minorities.”¹⁴¹

Two other major areas of racial disparity concerning the impacts of climate change are food security and the exclusion from ongoing government adaptation planning efforts. Like those of limited economic means, many people of color are uniquely vulnerable to disruptions in the food supply and associated nutritional problems. Although it is already the case that many minority communities in the United States have insufficient access to high quality, affordable food choices,¹⁴² these communities “are more likely to be affected because they spend a relatively larger portion of their household income on food compared to more affluent households.”¹⁴³

Here too, the disproportionate food security risk from climate change exists even when the connection between race and poverty is removed from the equation. Thus, although “African Americans are more vulnerable to food price increases due to climate change or to climate and energy policy because they spend a higher percentage of their budgets on food than non–Hispanic whites,” it is also the case that “even when matched for income, African Americans spend a somewhat higher income share on food.”¹⁴⁴

Finally, with regard to government planning and adaptation for climate change, early indicators suggest that people of color are largely being left out of regional and local planning efforts. For example, a 2012 study surveyed the risks of climate change in six southern states with large minority populations (Arizona, Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) and concluded that despite city–level efforts and plans to address climate change, “none of the states in the region have formal and comprehensive adaptation plans in place, nor do they include communities of color, economically disadvantaged individuals, or other vulnerable populations.”¹⁴⁵ This is curious in light of available polling that

141. Alice Fothergill et al., *Race, Ethnicity and Disasters in the United States: A Review of the Literature*, 23 *DISASTERS* 156, 161 (1999) (“In the US many ethnic groups live in apartment buildings that are often older and contain unreinforced masonry, which are among the most susceptible to damage in a disaster.”).

142. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 125, at 253.

143. *Id.*

144. HOERNER & ROBINSON, *supra* note 123, at 17.

145. TEX. HEALTH INST., *CLIMATE CHANGE, ENVIRONMENTAL CHALLENGES AND VULNERABLE COMMUNITIES: ASSESSING LEGACIES OF THE PAST, BUILDING OPPORTUNITIES FOR THE FUTURE* 98 (2012), <http://jointcenter.org/docs/Report051512book.pdf>.

suggests that, unlike many issues identified as “environmental” causes, American racial minorities seem to be somewhat *more* concerned about climate change than white Americans.¹⁴⁶ Thus, these communities seem to be more aware of the grave risks they face, even as government planners seem to be somewhat oblivious to their plight.

In short, as is the case with the world’s poorest citizens, the impacts of climate change will fall disproportionately on the people who contributed the least to GHG emissions on a per capita basis. The situation with race and climate change is particularly troubling because unlike the unique risk imposed on the poor due to their lack of opportunity or disadvantaged status, the available research suggests there is a heightened risk for people of color *because* they are people of color.¹⁴⁷ This makes climate change a core issue for anyone working to promote racial equality, eliminate racial discrimination, or enforce civil rights.

C. WOMEN AND CLIMATE CHANGE

Like the economically disadvantaged and people of color, women will also suffer a disproportionate share of the effects of climate change. As is the case with people of color, women are already disproportionately impacted by environmental hazards—a problem that will only be magnified and exacerbated by climate change. This is particularly true in rural and developing areas, where “women are generally on the receiving end of the effects of increasing environmental degradation and depletion of natural resources, because of their involvement in, and reliance on, livelihoods and activities which depend directly

146. ROBERT P. JONES ET AL., BELIEVERS, SYMPATHIZERS, AND SKEPTICS: WHY AMERICANS ARE CONFLICTED ABOUT CLIMATE CHANGE, ENVIRONMENTAL POLICY, AND SCIENCE 14 (2014) (“Nonwhite Americans are significantly more likely than white Americans to be highly concerned about climate change. More than 7-in-10 Hispanic Americans and nearly 6-in-10 black Americans are very (46% and 36%, respectively) or somewhat (25% and 21%, respectively) concerned about climate change, compared to less than half of white Americans (23% and 20% respectively).”).

147. The disproportionate impacts upon (or even elimination of) native cultures is also exceedingly high. While the plights of small island communities and nation-states have received some attention, the impact of severe weather, drought, and other negative changes will also greatly affect native cultures in the United States. Already relegated to marginal or non-productive lands by centuries of openly genocidal policies, American Indian populations are particularly vulnerable to the threat of climate change, especially in the American Southwest. TEX. HEALTH INST., *supra* note 145, at 19.

on the natural environment.”¹⁴⁸ Environmental damage in these communities can “increase the distances that women have to walk in search of clean water and firewood in order to perform their daily household chores.”¹⁴⁹ Moreover, because women are more likely to be caretakers both at home and in healthcare settings,¹⁵⁰ when environmental conditions cause illness or injury, they shoulder most of that burden as well.¹⁵¹

There has been comparatively little written on gender and climate change in comparison to race and poverty, but the work that has been done paints a grim picture of how climate change will exacerbate the already disproportionate burdens on women concerning environmental impacts and natural disasters.¹⁵² Here too, there is a strong link between vulnerabilities caused by poverty and gender. As one study on gender and natural disasters explained:

Disasters are profoundly discriminatory, even those that are “natural” rather than man-made. Factors that were present before a disaster, such as poor social conditions, mean that some people in the disaster zone will be more affected than others. People living in poverty are much more vulnerable to the effects of natural disasters. *As women account for 70% of the 1.3 billion people worldwide living in extreme poverty (less than \$1 a day), it follows that when natural disasters hit poverty stricken areas, women are more likely to be affected than men.*¹⁵³

148. Fatima Denton, *Climate Change Vulnerability, Impacts, and Adaptation: Why Does Gender Matter?*, 10 GENDER & DEV. 10, 12 (2002).

149. *Id.* at 14–15. See also Anita L. Wenden, *Women and Climate Change: Vulnerabilities and Challenges*, in CLIMATE CHANGE AND HUMAN WELL-BEING 119, 121 (Inka Weissbecker ed., 2011) (noting women are primarily responsible for gathering food, water, and energy sources to prepare food and, as resources become scarcer, women’s workload increases and girls’ opportunities to attend school are put at risk).

150. WORLD HEALTH ORG., ADDRESSING SEX AND GENDER IN EPIDEMIC-PRONE INFECTIOUS DISEASES 4 (2007), <http://www.who.int/csr/resources/publications/SexGenderInfectDis.pdf>.

151. Anita L. Wenden, *Women and Climate Change: Vulnerabilities and Challenges*, in CLIMATE CHANGE AND HUMAN WELL-BEING 119, 122 (Inka Weissbecker ed., 2011).

152. The major flooding events in Baton Rouge Louisiana in September 2016 have expanded the public’s awareness of the unique threats natural disasters pose to at-risk women, including how public interest organizations in the State “are trying to prepare for the likely uptick in domestic violence incidents around Baton Rouge” that are expected to follow. See Lorena O’Neil, *The Link Between Natural Disasters and Domestic Abuse: Flooding in Louisiana Has Left Victims of Abuse Even More Vulnerable*, ATLANTIC (Sept. 28, 2016).

153. Rhona MacDonald, *How Women Were Affected by the Tsunami: A Perspective from Oxfam*, 2 PLOS MEDICINE 474, 474 (2005) (emphasis added); see also USAID, GENDER AND EXTREME POVERTY, GETTING TO ZERO: A USAID DISCUSSION SERIES 1 (2015).

As with the issue of race, however, the disproportionate risks of climate change for women are not simply a result of their overrepresentation among the world's poor. Rather, the available research shows that women's vulnerability to natural disasters "arises from social and cultural norms about, for instance, gendered divisions of labour, physical mobility, and who is entitled to take part in decision making at household and community levels."¹⁵⁴

Women also have a significantly increased risk of death from climate-induced natural disasters, including hurricanes and tsunamis, extreme heat events, and drought. As one study succinctly explained, "[N]atural disasters will kill directly, and indirectly via related post disaster events, more women than men."¹⁵⁵ This same study also found that the stronger the disaster, the stronger the effect on the gender gap in life expectancy was.¹⁵⁶

In this regard, the 2004 Southeast Asia tsunami provides a preview of the types of disparate impacts on women that might occur from climate change-related disasters, much the same way that Hurricane Katrina provides a window into how poverty and race determined the victims of that catastrophe.¹⁵⁷ The tsunami of December 26, 2004 killed an estimated 220,000 people, and left more than 1.5 million refugees in its wake. After the tsunami, Oxfam collected data from several villages in Indonesia, Sri Lanka, and India, and found that four times more women were killed than men.¹⁵⁸ For example, in Indonesia, Oxfam conducted survivor analyses of four villages and discovered that of the 676 survivors, only 189 were women—a three to one rate of death based on gender.¹⁵⁹ In one of the most affected villages, 80% of all fatalities were women.¹⁶⁰

154. Geraldine Terry, *No Climate Justice Without Gender Justice: An Overview of the Issues*, 17 GENDER & DEV. 5, 7 (2009).

155. Eric Neumayer & Thomas Plümper, *The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981–2002*, 97 ANNALS ASS'N AM. GEOGRAPHERS 551, 561–62 (2007).

156. *Id.* at 560; see also Terry, *supra* note 154, at 7 ("Since the start of the twenty-first century, several extreme climate events have clearly demonstrated women's specific gendered vulnerability to disasters, including the 2003 heat wave in Europe, the Asian tsunami of 2004, and Hurricane Katrina, which devastated New Orleans in 2005. The cyclone that hit coastal Bangladesh in 1991 also killed many more women than men.")

157. Like Hurricane Katrina, the 2004 tsunami was not caused by climate change, but still provides a sense of how climate-induced disasters might affect the most vulnerable elements of society.

158. See OXFAM INT'L, *THE TSUNAMI'S EFFECT ON WOMEN 2* (2005).

159. *Id.* ("[I]n the four villages in the Aceh Besar district surveyed by Oxfam for this report, only 189 of 676 survivors were female. Male survivors outnumbered female survivors by a ratio

The gender–death correlation was similar in India and Sri Lanka with the notable exception of the village of Pachaankuppam on the Southeastern tip of Sri Lanka where the only fatalities were women.¹⁶¹ There are several potential reasons for this disparity of risk, some of which have already been mentioned, including women’s traditional role as caretakers for children and the elderly, and also gender differences in how certain survival skills—including swimming—are taught.¹⁶² In many cases women drown “in their attempts to save their children and elderly relatives who were with them at the time.”¹⁶³

Perhaps the most disturbing correlation between women’s rights and climate change is the massive increase in domestic violence and sexual assault in the wake of natural disasters. For women who survive the initial impact of a natural disaster, the loss of shelter, food, and personal security has impacts that go far beyond the initial triggering event.¹⁶⁴ A study that looked at the gendered impacts of Hurricane Andrew and the Red River Valley Flood concluded that after these events women were at a higher risk for violence due to lack of housing and safe space.¹⁶⁵ Likewise, a survey of U.S. and Canadian domestic violence shelters found that 9 out of 13 shelters severely impacted by a disaster reported increased demand for services following the disaster; many shelters reported increased service demands six months to one year after the disaster.¹⁶⁶ The authors concluded that “[w]hen their own support systems are disrupted or destroyed, women and children already traumatized by violence must cope with new losses and may be forced to remain or return to unsafe living conditions with violent partners.”¹⁶⁷

of almost 3:1. In four villages in North Aceh district, out of 366 deaths, 284 were females: females accounted for 77 per cent (more than three–quarters) of deaths in these villages.”).

160. *Id.*

161. *Id.*

162. See Neumayer & Plümper, *supra* note 155, at 553–54; OXFAM INT’L, *supra* note 158, at 6 (“Another major factor is that the skills that helped people survive the tsunami, especially swimming and tree climbing, are taught to children in Sri Lanka to perform tasks that are done nearly exclusively by men.”).

163. OXFAM INT’L, *supra* note 158, at 6.

164. *Id.*

165. Elaine Enarson, *Women and Housing Issues in Two U.S. Disasters: Hurricane Andrew and the Red River Valley Flood*, 17 INT’L J. MASS EMERGENCIES & DISASTERS 39, 46–47 (1999).

166. Elaine Enarson, *Violence Against Women in Disasters: A Study of Domestic Violence Programs in the United States and Canada*, 5 VIOLENCE AGAINST WOMEN 742, 756 (1999).

167. *Id.* at 757, 763 (“Escalating or renewed violence in already violent relationships, lack of alternative housing and other support services in disrupted communities, and referrals from disaster outreach workers help account for increased service demand.”).

Here again, the 2004 tsunami paints a grim picture of the unique threats women face from any climate-change related increase in extreme weather events, such as hurricanes, flooding, or other natural disasters. Following the 2004 tsunami, “girls and women in affected areas were subjected to rape and other forms of physical and sexual abuse.”¹⁶⁸ Among the many reported incidences were “the rape of a young woman by her ‘rescuer’ after being saved from the waves” as well as “the gang rape of two women on a beach they visited to view the destruction.”¹⁶⁹ Following the tsunami, “over two thirds of respondents felt certain that relationships had become more violent,” and local domestic violence support service referrals doubled.¹⁷⁰

For women seeking help at government or non-profit disaster shelters or refugee centers, their experience can be equally or more dangerous. A study of gendered impact in Nicaragua and Honduras following Hurricane Mitch found that a “particular problem that occurs in shelters is rape and sexual harassment of young women and teenagers, and even young girls,” and that “things are made worse if the shelter management are not aware of this situation or if health services specifically designed for women are not available.”¹⁷¹ Similar findings were reported after the 2004 tsunami in Sri Lanka, where “[i]ncidents of rape, sexual abuse, harassment, and molestation continued in accommodation centers, beyond the disaster’s emergency phase.”¹⁷²

Another study found that, “the imbalanced male-to-female survival ratio ha[s] resulted in several gender specific problems,” for example, “women in the camps are often verbally and physically harassed by men and are at risk of being sexually abused.”¹⁷³ That study reported numerous examples of violence against women in post-disaster relief areas:

168. Sarah Fisher, *Violence Against Women and Natural Disasters: Findings from Post-Tsunami Sri Lanka*, 16 VIOLENCE AGAINST WOMEN 902, 907 (2010).

169. *Id.*

170. *Id.* at 908 (“Respondents felt that domestic violence was fueled by a combination of factors. These included psychological trauma, stresses and pressures associated with loss of homes and livelihoods, and poor conditions and lack of privacy in accommodation centers. In addition, male alcohol consumption was believed to have increased and, in turn, contributed to increased violence.”).

171. SARAH BRADSHAW, UNITED NATIONS ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN, *SOCIO-ECONOMIC IMPACTS OF NATURAL DISASTERS: A GENDER ANALYSIS* 33 (2004).

172. Fisher, *supra* note 168, at 909.

173. Rhone MacDonald, *How Women Were Affected by the Tsunami: A Perspective from Oxfam*, 2 PLOS MEDICINE 474, 474 (2005).

Interviewees were able to recount specific, and sometimes numerous, incidents of domestic violence in temporary shelters. Husbands blaming their partners for failing to save their children from the waves was a common context for abuse. Male violence was used as a means of control and dominance during arguments over financial matters. Reported incidents in accommodation centers included a man severing his wife's leg with a shovel and another stripping his wife naked in public and attacking her with a broken bottle. Some incidents were fatal. A woman reportedly died after being set on fire by her husband following a dispute over his expenditure of the family's compensation money on alcohol. Other reported cases led to suicide or attempted suicide.¹⁷⁴

In short, as with the issues of race and poverty, due to already deeply embedded social inequality for women, gender plays a huge role in determining who will pay the price for unmitigated climate change emissions. Although the available research suggests that the disproportionate impacts on women decrease in relation to their relative status and rights within a particular culture,¹⁷⁵ the bottom line is that the vast majority of women in the world have substantially more to lose from climate change than their male counterparts, and that the prevention or mitigation of climate change by definition is a priority issue for anyone working to advance women's rights, or to prevent domestic violence and sexual assault.

D. CHILDREN AND CLIMATE CHANGE

As the foregoing discussion makes obvious, children are also disproportionately at-risk from climate change. Leaving aside the serious issue of society's duties, both ethical and legal, to future generations,¹⁷⁶ the unique risks climate change poses to children already in existence should be more than enough to spur children's health and welfare advocates into action. Like other at-risk populations discussed above, "[a]lmost all of the disproportionate impacts for

174. Fisher, *supra* note 168, at 908.

175. Neumayer & Plümer, *supra* note 155, at 561–62 (“The higher women’s status, the smaller is the differential negative effect of natural disasters on female relative to male life expectancy. What this means is that where the socioeconomic status of women is high, men and women will die in roughly equal numbers during and after natural disasters, whereas when the socioeconomic status of women is low, more women than men die (or women die at a younger age).”).

176. *See, e.g.*, DOUGLAS A. KYSAR, REGULATING FROM NOWHERE: ENVIRONMENTAL LAW AND THE SEARCH FOR OBJECTIVITY (2012).

children are exacerbated by poverty and by the difficult choices that must be made by poor households as they adapt to more challenging conditions.”¹⁷⁷

Children are also already uniquely vulnerable to environmental pollution, especially GHG emissions. As one study on climate change and children’s health explained, “[c]hildren are especially vulnerable to both short-term illness and long-term damage from ambient air pollution, because their lungs are developing and growing, they breathe at a higher rate than adults, and they spend more time outdoors engaging in vigorous physical activity.”¹⁷⁸ The American Academy of Pediatrics did not mince words in a 2015 report on the unique threats to children when it comes to climate change:

The effects of climate change on child health include: physical and psychological sequelae of weather disasters; increased heat stress; decreased air quality; altered disease patterns of some climate-sensitive infections; and food, water, and nutrient insecurity in vulnerable regions. The social foundations of children’s mental and physical health are threatened by the specter of far-reaching effects of unchecked climate change, including community and global instability, mass migrations, and increased conflict. *Given this knowledge, failure to take prompt, substantive action would be an act of injustice to all children.*¹⁷⁹

This heightened risk to children is significantly greater in the less-wealthy countries most vulnerable to climate change, where children make up nearly half of the population, in comparison to approximately 20% in wealthy northern hemisphere countries.¹⁸⁰

One of the greatest risks to children is the increased disease risk associated with both warming temperatures and reduced access to potable water. According to data collected by the World Health Organization, children under the age of five bear 88% of the burden of diseases attributable to climate change.¹⁸¹ As many as

177. Sheridan Bartlett, *The Implications of Climate Change for Children in Lower-Income Countries*, 18 CHILD., YOUTH & ENVIRONMENTS 71, 73 (2008).

178. Katherine M. Shea, *Global Climate Change and Children’s Health*, 120 PEDIATRICS e1359, e1362 (2007).

179. Council on Human Health, *Global Climate Change and Children’s Health*, 138 PEDIATRICS 1, 1 (2015) (emphasis added).

180. Bartlett, *supra* note 177, at 75.

181. Ying Zhang et al., *Climate Change and Disability-Adjusted Life Years*, 70 J. ENVTL. HEALTH 32, 33 (2007).

24% of all deaths in children under 15 are already due to environmentally–related diarrhea, malaria, and respiratory infections.¹⁸²

According to the WHO, these illnesses are likely to become more prevalent with climate change:

Viruses and bacteria transmitted through water and contaminated food can cause severe diarrhea in children, often locking them into a vicious cycle of undernourishment, susceptibility to other infectious diseases, and eventually death. *Higher temperatures and too much or too little water can all facilitate transmission of this disease. In countries with inadequate water and sanitation services, diarrhea is much more common when temperatures are high.*¹⁸³

The increased risk with respect to malaria is particularly problematic, since children are already “at increased risk for vector–borne diseases because of more time spent outdoors with potentially greater exposure to vectors,”¹⁸⁴ because “they lack specific immunity” and therefore “experience disproportionately high levels of both morbidity and mortality from malaria.”¹⁸⁵ Of the more than one million total malaria deaths each year, 75% of the victims are children younger than 5 years.¹⁸⁶

The prevalence of diseases like malaria is on the rise worldwide, and “[f]ifty percent of the world’s population is now considered to be at risk, a 10% increase in the last decade.”¹⁸⁷ The cause of this increase is no secret. According to one leading study, “[c]limate change is expanding the range of host mosquitoes to higher altitudes and higher latitudes, and warmer temperatures speed the development of the parasite within the host vector.”¹⁸⁸ Climate change–induced weather shifts are also opening up opportunities for the reemergence of diseases

182. A. PRÜSS–ÜSTÜN & C. CORVALÁN, WORLD HEALTH ORG., PREVENTING DISEASE THROUGH HEALTHY ENVIRONMENTS: TOWARDS AN ESTIMATE OF THE ENVIRONMENTAL BURDENS OF DISEASE 62 (2006), http://www.who.int/quantifying_ehimpacts/publications/preventingdisease.pdf.

183. WORLD HEALTH ORG., PROTECTING HEALTH FROM CLIMATE CHANGE 11 (2008), http://www.who.int/world-health-day/toolkit/report_web.pdf (emphasis added).

184. Kristie L. Ebi & Jerome A. Paulson, *Climate Change and Children*, 54 PEDIATRIC CLINICS N. AM. 213, 219 (2007).

185. Shea, *supra* note 178.

186. *Id.*

187. Sheridan Bartlett, *Climate Change and Urban Children: Impacts and Implications for Adaptation in Low- and Middle-Income Countries*, 20 ENV’T & URBANIZATION 501, 507 (2008).

188. Shea, *supra* note 178.

that have previously been eradicated from many regions. Available vectors for dengue fever, malaria, and other diseases commonly thought of as only international problems “are present in many regions of the United States, so there are constant risks for reintroduction of these diseases” as they “alter their ranges with changes in temperature and precipitation.”¹⁸⁹

As discussed above in reference to poverty, the reduction in clean water and available food associated with shifting weather patterns will increase the incidence of malnutrition and “stunting” in children. The absence of clean and potable water leads to “frequent bouts of diarrhea and infestations of worms,” a resulting “impaired absorption and a loss of nutrients,” and “calories that should go towards growth are spent instead supporting their challenged immune systems.”¹⁹⁰ According to the World Bank, “7.5 million children are expected to be stunted by 2030, of whom 3.9 million would be affected by severe stunting.”¹⁹¹

Children are also uniquely at risk from climate induced natural disasters, such as hurricanes, floods, and heat waves. According to the Council on Human Health, “extreme weather events place children at risk for injury, loss of or separation from caregivers, exposure to infectious diseases, and a uniquely high risk of mental health consequences, including posttraumatic stress disorder, depression, and adjustment disorder.”¹⁹² Such events “cause irrevocable harm to children through devastation of their homes, schools, and neighborhoods, all of which contribute to their physiologic and cognitive development.”¹⁹³

Children are also “more likely than adults to perish during natural disasters,”¹⁹⁴ more likely to “succumb to malnutrition, injuries or disease in the aftermath,”¹⁹⁵ less likely to receive healthcare and other aid,¹⁹⁶ and more likely to be subjected to exploitation or abuse.¹⁹⁷ For example, a study of the aftermath of Hurricane Mitch in Nicaragua in 1988 found that “[c]hildren in areas directly affected by the storm were 30% less likely to be taken for medical consultation

189. Ebi & Paulson, *supra* note 184, at 219.

190. Bartlett, *supra* note 177, at 79.

191. Stephane Hallegatte et al., *supra* note 95, at 124.

192. Council on Human Health, *supra* note 179, at 2.

193. *Id.*

194. U.N. CHILDREN’S FUND, CLIMATE CHANGE AND CHILDREN 6 (2007).

195. *Id.*

196. Stephane Hallegatte et al., *supra* note 95, at 115.

197. U.N. CHILDREN’S FUND, *supra* note 194, at 6 (“Natural disasters may force children out of their homes – or even their countries. They may become orphaned or separated from their families, and may be preyed upon by opportunistic adults.”).

conditional on being sick, even though there was no significant difference in the prevalence of illness between affected and non-affected children.”¹⁹⁸ Similarly, a survey of heat wave mortality in several counties concluded that “children suffer directly from the increased severity and duration of heat waves” and documented an “increase in child morbidity and mortality during extreme heat events.”¹⁹⁹ Heat waves tend to “have the most severe impacts for the elderly and the very young, who sweat less and have a greater surface area-to-body mass ratio.”²⁰⁰

With climate scientists predicting an increase in heat wave deaths in the U.S. alone of up to 10,000 per year within the next 15 years, the special vulnerability of children to such extreme weather events is cause for alarm. As is the case with gender, race, and poverty, the tearing of the social fabric of society due to climate change will have disproportionate impacts on children—even leaving out the obvious fact that they will live longer and thus experience more of the ill-effects than contemporary adults. And these impacts will not be limited to direct mortality and disease.

As the leading study on children and climate change makes clear, “children’s biological and cognitive development occurs within the context of stable families, schools, neighborhoods, and communities,” and, “[u]nchecked climate change threatens the safety and well-being of children via its effects on this broader social context.”²⁰¹ Climate change chips away at economic development, food and water security, and public health—while increasing armed conflict, competition for resources, and domestic violence—so the “social support” critical for child biological and psychological development will continue to diminish.²⁰² The net result will be future generations becoming less and less physically capable of dealing with more and more adverse effects of climate change—another dangerous “negative feedback” that mimics the underlying problem of GHG emissions.

198. Javier E. Baez & Indhira V. Santos, *Children’s Vulnerability to Weather Shocks: A Natural Disaster as a Natural Experiment*, SOC. SCI. RES. NETWORK 27 (2007).

199. Council on Human Health, *supra* note 179, at 3.

200. Bartlett, *supra* note 177, at 80.

201. Council on Human Health, *supra* note 179, at 3.

202. *Id.*

E. THE REFUGEES OF CLIMATE CHANGE

Environmental refugees are not a new phenomenon, nor are they unique to the climate change issue. The United Nations began talking about environmental refugees at least as early as 1985, identifying them as “those people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life.”²⁰³ What is unique is the degree to which the effects of climate change will dwarf and redefine what we mean by the term “environmental refugee.” Indeed, many are already suggesting that the phrase “climate migrant” is more appropriate.²⁰⁴

Although the impact of climate change on human migration patterns has been more fully explored in the literature than some other impacts, and is better understood among the general public, it merits discussion here not only because of the incomprehensible scope of the coming shift in global populations trapped in the crosshairs of climate change but also because of its significant interrelationship with poverty, racial and gender discrimination, and the plight of children discussed above. To be clear, the issue of climate migrants or refugees is not some far-off prediction or another doomsday scenario for 2050, but rather an issue where climate change is already having a detectable effect.²⁰⁵

As one leading study explained:

In coming decades, climate change will motivate or force millions of people to leave their homes in search of viable livelihoods and safety. Although the precise number of migrants and displaced people may elude science for some time, the mass of people on the move will likely be staggering and surpass any historical antecedent.²⁰⁶

203. David Keane, *The Environmental Causes and Consequences of Migration: A Search for the Meaning of “Environmental Refugees”*, 16 GEO. INTL ENVTL. L. REV. 209, 219–20 (2004) (quoting Essam El-Hinnawi, U.N. ENVTL. PROGRAM, *Environmental Refugees* 4 (1985)).

204. Oli Brown, *Migration and Climate Change: International Organization for Migration (IOM) Research Series*, 31 INT’L ORG. MIGRATION 13–15 (2008), http://publications.iom.int/system/files/pdf/mrs-31_en.pdf.

205. Koko Warner et al., *In Search of Shelter: Mapping the Effects of Climate Change on Human Migration and Displacement*, CARE CLIMATE CHANGE iv (2009), http://www.careclimatechange.org/files/reports/CARE_In_Search_of_Shelter.pdf.

206. *Id.* at 1.

In the U.S. alone, nearly 20,000,000 people are expected to be displaced by rising sea levels in the next 13 years.²⁰⁷ Because those displaced will have to move to alternative destinations, the effects of sea-level rise will be felt throughout the United States.²⁰⁸ A report by the U.S. Geological Survey finds that almost 50% of the East Coast is at high risk or very high risk to be impacted by sea-level rise,²⁰⁹ and some “2150 towns and cities in the contiguous US have at least some residents living within one vertical meter of the high tide line.”²¹⁰

The limited evidence available so far suggests that state and federal governments are totally unprepared, both financially and logistically, to effectuate any kind of orderly relocation of 20,000,000 Americans. Rather, it is more likely that residents and their elected officials will sit in denial—as many already do concerning the larger issue of climate change—until the problem becomes a regional or national disaster. For example, as far back as 2002 the Alaskan village of Shishmaref (population of 563) voted to relocate the entire town because rising sea levels became an existential threat due to climate change, with the island’s shores eroding into the sea and “falling off in giant chunks whenever a big storm hit[.]”²¹¹ Despite the decision to move, the town is still there because local, state, and federal officials could not agree on funding or logistics for the move.²¹² In the meantime, the village is literally falling into the sea.

The Alaskan village of Kivalina, facing the same fate as Shishmaref, took the unprecedented step of filing a federal lawsuit against Exxon Mobil and several other energy companies to recover damages that would enable the village to either relocate or mitigate the damage that climate change has wrought upon their

207. Katherine J. Curtis & Annemarie Schneider, *Understanding the Demographic Implications of Climate Change: Estimates of Localized Population Predictions Under Future Scenarios of Sea-Level Rise*, 33 POPULATION & ENV'T 28, 46 (2011).

208. *Id.*

209. U.S. GEOLOGICAL SURVEY, NATIONAL ASSESSMENT OF COASTAL VULNERABILITY TO FUTURE SEA-LEVEL RISE 2 (2000), <http://pubs.usgs.gov/fs/fs76-00/fs076-00.pdf>.

210. Benjamin H. Strauss et al., *Tidally Adjusted Estimates of Topographic Vulnerability to Sea Level Rise and Flooding for the Contiguous United States*, 7 ENVTL. RES. LETTERS 5 (2012), <http://iopscience.iop.org/article/10.1088/1748-9326/7/1/014033/pdf>.

211. Kate Sheppard, *Climate Change Takes a Village as the Planet Warms, A Remote Alaskan Town Shows Just How Unprepared We Are*, HUFFINGTON POST (Dec. 14, 2014), http://www.huffingtonpost.com/2014/12/14/shishmaref-alaska-climate-change-relocation_n_6296516.html.

212. *Id.*

community.²¹³ That lawsuit failed for a number of reasons, including the inadequate efforts by EPA to regulate GHG emissions under the Clean Air Act.²¹⁴

Shishmaref and Kivalina are not isolated examples. Indeed, the Government Accountability Office has found that most of the 200 Alaska Native villages are experiencing flooding and erosion related to climate change.²¹⁵ As one journalist has succinctly explained, “[i]f we can’t figure out how to save a village with fewer than 600 people from falling into the sea, what hope is there for everyone else?”²¹⁶ This is a particularly important question given that 200 Alaskan villages are a drop in the climate change bucket compared to the roughly 20,000,000 Americans that will have to relocate—apparently on their own and without any governmental assistance—within the next 13 years.

The unplanned migration of some 20 million people over a relatively short period of time “will place numerous institutional and social pressures on receiving counties, including the availability and affordability of housing, seats in classrooms, and job opportunities as well as social interactions between different ethnic and socioeconomic groups.”²¹⁷ In light of the rising tide of anti-immigrant sentiment in the U.S. in general, and the likelihood that many of these migrants will be either poor or people of color, this new class of climate migrants is likely to experience at best localized discrimination and at worst open persecution.

The potential impacts of this mass migration at the international level are even more staggering to contemplate. The numerical predictions of climate change-related displacement and migration are varied, but most estimates “range between 25 million and 1 billion people by 2050.”²¹⁸ A report issued by the Asian Development Bank highlighted that 42 million people were displaced by sudden-onset, climate-related, and extreme weather events in 2010 and 2011 in Asia

213. *Native Village of Kivalina v. ExxonMobil Corp.*, 696 F.3d 849 (9th Cir. 2012).

214. Hadyn Davies, *Native Villagers’ Demand for Climate Justice Exposes the Limitations of Federal Common Law*, 15 ENVTL. L. REV. 1, 1 (2013).

215. U.S. GEN. ACCOUNTING OFFICE, *ALASKAN NATIVE VILLAGES: MOST ARE AFFECTED BY FLOODING AND EROSION, BUT FEW QUALIFY FOR FEDERAL ASSISTANCE* (2003).

216. Kate Sheppard, *If We Can’t Stop this Tiny Alaskan Town from Falling into the Sea, What Hope is There for the Rest of Us? The Lesson of the Doomed Town of Shishmaref, Alaska*, MOTHER JONES (Dec. 15, 2014), <http://www.motherjones.com/environment/2014/12/alaskan-town-shows-just-how-unprepared-we-are-climate-change>.

217. Curtis & Schneider, *supra* note 207, at 48.

218. Oli Brown, *supra* note 204, at 12; *see also* CHRISTIAN AID, *HUMAN TIDE: THE REAL MIGRATION CRISIS*, 7 (2007), <https://www.christianaid.org.uk/Images/human-tide.pdf> (estimating that 250 million people will be *permanently* displaced by climate change including floods, droughts, famines, and hurricanes).

alone.²¹⁹ Although the report notes that it is difficult to disentangle events induced by climate change from other environmental events, it predicts that “these figures are likely to grow over time as Asian coastal mega cities will endure recurrent flooding due to climate change.”²²⁰

In this regard the Syrian civil war mentioned above provides a good, and yet comparatively minor, example of the type of mass migrations that are likely to continue to occur as the impacts of climate change continue to manifest themselves throughout the world. Although it was fueled by a number of factors, many observers believe that years of extreme drought in an area that had long experienced conflicts over access to water resources was a major causal factor in the Syrian crisis.²²¹ The drought in turn drove more than a million rural residents into the urban centers of the country, where they were unable to find assistance, and ended up living in extreme poverty with no hope of escape—prime conditions for civil unrest.²²² This influx of poor and unemployed Syrians, combined with longstanding problems of government corruption, inequality, and an already staggering Iraq war refugee problem, is thought to have been a triggering factor for a five-year civil war that has displaced more than 5,000,000 refugees.²²³

As discussed above, the crush of 5,000,000 Syrian refugees upon the world community is relatively minor when compared to the estimated 20,000,000 domestic climate refugees expected in the U.S., and the potential for 1,000,000,000 more climate migrants worldwide—a figure that does not include potential increases triggered by any armed conflicts precipitated by climate change. Thus, as dramatic footage of struggling and dying Syrian refugees flooded Western media outlets in 2016, the wealthy GHG-emitting countries were not only looking at the direct results of their own failure to control GHG emissions, they were also looking at a future of climate change-fueled conflict that is not scheduled to arrive some time in 2050 or beyond, but rather is emerging right now throughout the world.

219. ASIAN DEVELOPMENT BANK, ADDRESSING CLIMATE CHANGE AND MIGRATION IN ASIA AND THE SOUTH PACIFIC: FINAL REPORT 2–3 (2012).

220. *Id.*

221. Colin P. Kelley et al., *Climate Change in the Fertile Crescent and Implications of the Recent Syrian Drought*, 112 PROC. NAT’L ACAD. SCIS. 3241, 3241 (2015).

222. *Id.*; see also *supra* note 120 and accompanying text.

223. Colin P. Kelley, *supra* note 221, at 2.

F. ANIMALS AND CLIMATE CHANGE

Like the issue of refugees and climate change, the connection between changing climate patterns and wildlife loss is more apparent to the general public than many other impacts discussed herein. A much lesser-known, and indeed almost hidden impact of human-caused climate change is its effect on captive, farmed, and companion animals. Unlike climate change impacts on polar bears and other wildlife, the effects of extreme weather events, flooding, drought, changing vegetation patterns, and other climate change impacts on billions of captive and companion animals are virtually absent from the climate change literature.

Among all the members of the biotic community, wildlife and other animals are uniquely vulnerable because, unlike humans, they have no ability to plan, mitigate, or (in many cases) migrate away from the impacts of climate change. Even given all the challenges described above (including poverty, racism, sexism, and discrimination against displaced persons) humans still have a better chance of avoiding or surviving the effects of climate change—assuming we have the money and political will to do so. For wildlife and domestic animals, the problem is much more diffuse and intractable. Huge changes in traditional weather patterns, ocean temperatures, and terrestrial habitats will simply eliminate the ability of billions of animals to survive and adapt.

These impacts are important to understand and internalize, as the world's wildlife is already disappearing because of climate change. This is not something coming in five, ten or twenty years; it is underway right now. Natural populations of non-human animals are literally the canaries in the coalmine—showing us what is coming for human animals in short order. The plight of wildlife in an era of climate change is already recognized as critically important to national environmental organizations because of the loss of biodiversity and the elimination of entire species. Although major animal protection groups recognize and decry the impacts of climate change generally, they have not yet engaged the issue of climate change, nor do they appear to have internalized the massive suffering and loss of animal life that is already well underway across the globe.

As discussed herein, the impending deaths of billions of wild and other animals due to climate change should be a top priority for the animal protection movement—especially given its recent trend toward quantification of suffering in

making strategic decisions.²²⁴ So the question becomes, as with climate impacts on other social movements, why are animal advocates (and the general public) not more activated by the huge loss of wildlife due to climate change? The answer, once again, has to do with the language of climate change. And the solution is, once again, to redefine how we talk about and conceptualize this loss in a way that resonates beyond the halls of conservation biology departments.

For example, the majority of this discussion concerning the impacts of climate change on wildlife will proceed in the environmental language of “species loss”—a method of quantifying climate change impacts that is fundamentally different from how we describe climate impacts on humans, thereby masking the full impacts of climate change. Unfortunately, there is limited scientific source material from which a description of total wildlife lives at risk from climate change might be constructed. Although as discussed below, there does appear to be enough raw data to offer some gross translations from predictions about likely loss of “species” to the number of animal “lives” at risk, this entire inquiry is one that is desperately in need of additional exploration and quantification. Sadly, this lack of concrete quantification is perhaps the best (or worst) example of how the current language of climate change hampers efforts to change climate policy in the U.S. and abroad. Nevertheless, this discussion shall proceed with the blunt tools at hand, which even in the abstract language of “species loss” paint an extremely grim picture of the impacts of climate change upon animals.

224. Daniel Engber, *Save the Chicken: A Few Decades Ago, No One Cared About Chicken Welfare. Now All Our Eggs are About to be Cage-Free. Why?*, SLATE (Aug. 18, 2016), http://www.slate.com/articles/health_and_science/science/2016/08/animal_activists_crunched_the_numbers_to_learn_that_the_creature_most_in.html (exploring the animal protection movement’s recent trend towards deploying cost–benefit economic models and accompanying efforts to quantify relative suffering of different animals in selecting advocacy strategies.). There is much to be gained by focusing on advocacy that will relieve the most suffering for the most animals, but just as Professor Kysar has pointed out the dangers of relying too much on cost–benefit analysis in environmental policymaking, see Kysar, *supra* note 176, efforts to quantify animal suffering can go too far, and lead to bizarre utilitarian conclusions. For example, a few utilitarian–focused animal rights activists have suggested wild animal lives might not be worth saving (or presumably should be affirmatively extinguished) because the background levels of suffering they confront as members of a natural ecosystem are worse than death. This sort of extreme vetting of the relative value of non–human animal life by self–appointed, human–controlled wildlife death panels is not only shockingly paternalistic, it is also precisely the kind of human–centric, interventionist thinking that justified the mass–extirpation and wholesale exploitation of non–human animals over the last 10,000 years. As Mr. Engber wisely quips in his piece, “[t]hat’s the thing about the numbers–based approach to helping animals: It seems reasonable and rational up until the moment when it sounds totally insane.”

The basic contours of species loss from climate change are relatively well-known, and have been introduced to the wider public through highly influential works like Elizabeth Kolbert’s 2014 book “The Sixth Extinction.”²²⁵ Species loss is not a new phenomenon, nor is it the exclusive provenance of climate change. Conservation biologists estimate that a normal (that is, absent human intervention) background rate of extinction is less than one species for every million species, each year.²²⁶ However, this rate has dramatically increased over the last 50 years. Famed conservation biologist E.O. Wilson estimated that we were losing species at a rate of 27,000 per year or three per hour in 1992,²²⁷ and that rate has now increased to the point at which “current extinction rates are 1,000 times higher than natural background rates of extinction, and future rates are likely to be 10,000 higher.”²²⁸

Since 1970, more than half of the world’s birds, reptiles, mammals, fish, and amphibian species have been lost, with 39% of land species extinguished, 39% of marine species extinguished, and 76% of freshwater species extinguished.²²⁹ Globally, between 12% and 30% of all bird, mammal, reptile, and amphibian species are considered “threatened or vulnerable.”²³⁰ In 2000, the Nature Conservancy issued a comprehensive report concluding that North America has a broader diversity of ecosystems than any other place on Earth, but that a third of the estimated 200,000 species of birds, mammals, reptiles, and amphibians on the continent are at risk of extinction.²³¹

This unprecedented period of species loss has led conservation scientists to declare that the world has entered a new “epoch,” and dubbed it the “Anthropocene” because it marks the period in which human influence on global ecosystems is pronounced enough to define the trajectory of all life on the planet. The moniker is considered appropriate because “[a]s a driver of global change,

225. ELIZABETH KOLBERT, *THE SIXTH EXTINCTION: AN UNNATURAL HISTORY* (2014).

226. Jurriaan DeVos et al., *Estimating the Normal Background Rate of Species Extinction*, 29 CONSERVATION BIOLOGY 452, 452 (2014).

227. E.O. WILSON, *THE DIVERSITY OF LIFE* 28 (1992).

228. DeVos, *supra* note 226, at 452.

229. WORLD WILDLIFE FUND, *LIVING PLANET REPORT 12* (2014).

230. *Id.*; see also INT’L UNION FOR CONSERVATION OF NATURE, *THE IUCN RED LIST OF THREATENED SPECIES, VERSION 2016–1* (2016).

231. See DALE GOBLE & ERIC FREYFOGLE, *WILDLIFE LAW CASES AND MATERIALS* 1049–50 (2010), citing STEIN ET AL., *PRECIOUS HERITAGE: THE STATUS OF BIODIVERSITY IN THE UNITED STATES* (2000).

humanity has outstripped geology.”²³² As explained by Paul J. Crutzen, who popularized the concept of the Anthropocene:

The Anthropocene could be said to have started in the latter part of the eighteenth century, when analyses of air trapped in polar ice showed the beginning of growing global concentrations of carbon dioxide and methane. This date also happens to coincide with James Watt’s design of the steam engine in 1784.²³³

The Anthropocene is now an influential concept in a number of fields (scientific, social scientific, and humanities) because it undermines the idea that nature is separate and apart from human civilization—a binary that’s been fundamental to Western science and philosophy since Ancient Greece. The notion that nature is outside of civilization is also baked into mainstream thinking about conservation and, especially, environmental laws. As explained by Jedediah Purdy in his recent book *After Nature: A Politics for the Anthropocene*, federal initiatives like national parks, wildlife refuges, and the Endangered Species Act are premised on the notion that “human beings can save everything, if only we limit our incursions into ecologically important places. This proved unrealistic. The human impact on habitat is so pervasive that, in practice, the question is not how to save everything, but what to save and why, a question that the ESA gives scant help in addressing.”²³⁴

The rate of species loss has become so great that conservation scientists increasingly believe that the sixth mass extinction event in Earth’s history, as measured by rate of biodiversity loss suddenly and sharply spiking, is already underway. Mass extinction events are ordinarily defined as “times when the Earth loses more than three-quarters of its species in a geologically short interval, as

232. JEDEDIAH PURDY, *AFTER NATURE: A POLITICS FOR THE ANTHROPOCENE* 1 (2015).

233. Paul J. Crutzen, *Geology of Mankind*, 415 *NATURE* 23 (2002) (“For the past three centuries, the effects of humans on the global environment have escalated. Because of these anthropogenic emissions of carbon dioxide, global climate may depart significantly from natural behaviour for many millennia to come. It seems appropriate to assign the term ‘Anthropocene’ to the present, in many ways human-dominated, geological epoch, supplementing the Holocene — the warm period of the past 10–12 millennia.”).

234. PURDY, *supra* note 232, at 213 (“As climate change shifts habitat zones, preserving species becomes a matter of active management — for instance, moving animal populations from region to region or creating pathways for migration so that species in jeopardy can move themselves. The ESA, which works mostly by forbidding harm to species and habitats *as we find them*, provides few tools for this kind of work.”).

has happened only five times in the past 540 million years or so.”²³⁵ An increasing chorus of scientists have concluded that “[t]he evidence is incontrovertible that recent extinction rates are unprecedented in human history and highly unusual in Earth’s history,” and that “global society has started to destroy species of other organisms at an accelerating rate, initiating a mass extinction episode unparalleled for 65 million years.”²³⁶

Outside the circle of climate change denial politics, there is no question that climate change is one of the key drivers of this mass extinction event. Although a number of other anthropogenic factors have contributed (exploitation, conventional pollution, habitat destruction), human-caused climate change is poised to be the overwhelming driver both in terms of magnitude and geographic scale.²³⁷ This should not be much of a surprise from a historical perspective. Non-anthropogenic climate change has been a key driver of previous mass extinction events throughout the Earth’s history. The most famous mass extinction event—the Cretaceous–Tertiary extinction, which killed off large numbers of land and marine species, including all non-avian dinosaurs about 66 million years ago—is thought to have been triggered by an asteroid impact off the Yucatan peninsula (the “Chicxulub Asteroid”).²³⁸ The devastating global effect was not from the impact itself but rather because “the impact release of large quantities of water, dust, and climate-forcing gases” that “dramatically alter[ed] the climate system,” causing “a catastrophic impact winter.”²³⁹

The specific environmental alterations through which current climate change manifests itself to the detriment of wildlife are well-known, and have already been discussed in reference to the human victims of climate change. As with its

235. Anthony D. Barnosky et al., *Has the Earth’s Sixth Mass Extinction Already Arrived?*, 471 NATURE 51 (2011) (Article credited with sparking current conversation about human-caused mass extinction); Gerardo Ceballos et al., *Accelerated Modern Human-Induced Species Losses: Entering the Sixth Mass Extinction*, 1 SCIENCE ADVANCES 1, 1–5 (2015).

236. Ceballos, *supra* note 235, at 1–5.

237. David B. Wake & Vance T. Vredenburg, *Are We in the Midst of the Sixth Mass Extinction? A View from the World of Amphibians*, 105 PROC. NAT’L ACAD. SCI. 11466, 11467 (2008) (“Many scientists think that we are just now entering a profound spasm of extinction and that one of its main causes is global climate change”); *see generally* KOLBERT, *supra* note 225.

238. Walter Alvarez et al., *Extraterrestrial Cause for the Cretaceous–Tertiary Extinction*, 208 SCI. 1095–1108 (1980).

239. Peter Schulte et al., *The Chicxulub Asteroid Impact and Mass Extinction at the Cretaceous–Paleogene Boundary*, 327 SCIENCE 1214, 1217 (2010); *see also* Paul R. Renne et al., *Time Scales of Critical Events Around the Cretaceous–Paleogene Boundary* 339 SCIENCE 684, 685–87 (2013).

other impacts, climate change affects wildlife through a complex and interrelated set of mechanisms. Some are direct—that is, where it’s literally too hot for a species adapted to a certain temperature range to survive, and there is no way for them to migrate. Some are indirect but straightforward—that is, where key habitat is destroyed by sea level rise or wildfire, or where warming allows parasites to survive through winters and therefore reproduce at a rate that consumes host plants that are staple food sources for animal species.²⁴⁰ A complete discussion of the myriad ways in which climate change is affecting wildlife populations is beyond the scope of this paper, but a few key areas are worth discussion—not only because of their significance for wildlife but because they are concrete examples of how particular wild species are *already being affected*, not some future projections of what could happen in 2050 or beyond.

For example, oceanic species—and particularly birds—are already being hard hit by climate change for the simple reason that over 90% of warming due to GHG emissions is being absorbed into the world’s oceans.²⁴¹ Over the last few years there have been increasing, and increasingly alarming, mass die-offs of birds and other marine species that are unprecedented and suggest that the mass destruction of wildlife is a precursor to other forthcoming climate change damage more directly affecting people. For example, in January 2016 the U.S. Fish and Wildlife Service reported that “[t]housands of dead and dying murrens have been washing up on beaches this year, from California to the Gulf of Alaska,” and that surviving murrens “have turned up at inland locations this winter, and have been observed swimming and presumably foraging in openings in rivers and lakes—both of which are unusual behaviors for seabirds.”²⁴²

The murre die-off follows many other similar events, including the thousands of dead short-tailed shearwaters that washed up on the shores of Tasmania in 2013 and 2014,²⁴³ as well as the death of thousands of Cassin’s auklets in 2015 spread across a vast area of the West Coast from San Francisco to British

240. See Jonathan R. Mawdsley et al., A Review of Climate Change Adaptation Strategies for Wildlife Management and Biodiversity Conservation, 23 CONSERVATION BIOLOGY 1080, 1081 (2009); Lee Hannah, *Impacts of Anthropogenic Climate Change on the Biology of Terrestrial and Marine Systems*, in WILDLIFE TOXICOLOGY: EMERGING CONTAMINANT AND BIODIVERSITY ISSUES 147–168 (Ronald J. Kendall et al. eds., 2010).

241. ROMM, *supra* note 26, at 22.

242. U.S. FISH & WILDLIFE SERV., ALASKAN SEABIRD DIE-OFF 1 (2016).

243. Deborah Gough, *Dead Birds ‘Not Just a Freak Event’*, SYDNEY MORNING HERALD (Oct. 30, 2013), <http://www.smh.com.au/environment/animals/dead-birds-not-just-a-freak-event-20131030-2wgzd.html>.

Columbia.²⁴⁴ According to reports, “[o]n some beaches the Cassin’s auklet death toll was a hundred times greater than any bird die-off ever tallied there, and six times worse per kilometer than the body count recorded after the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska.”²⁴⁵ The U.S. Geological Survey determined that “[t]here’s very little evidence of food in their GI [gastrointestinal] tracts or stomachs,” while a scientist at California’s Farallon Institute postulated that “the most likely scenario is that the deaths are related to a massive blob of warm water that heated the North Pacific last year and contributed to California’s drought and to 2014 being the hottest year on record.”²⁴⁶

These recent mass marine bird mortality events have been accompanied by a host of similar mass deaths of other ocean species, including the death of millions of starfish from Mexico to Alaska in 2014 and 2015,²⁴⁷ the mass stranding and deaths of pilot whales off the coast of India in January 2016,²⁴⁸ the 2015 mass stranding and deaths of fin, humpback, and gray whales in Alaska,²⁴⁹ and the mass stranding and deaths of Guadalupe Fur Seals—a species that is already listed as threatened under the federal Endangered Species Act—on California beaches in 2015 due to warming ocean temperatures.²⁵⁰ While it is still too early for scientists to conclusively tie these recent mass mortality events directly to climate change, the increasing magnitude and frequency of such events is impossible to ignore.

The high-profile and ongoing extirpation of Polar Bears and Adelie Penguins due to climate change induced melting ice caps, rising sea levels, and changing

244. Craig Welch, *Mass Death of Seabirds in Western U.S. is ‘Unprecedented’ – Why are so Many Auklets, from California to Canada, Starving?*, NAT’L GEOGRAPHIC (Jan. 24, 2015), <http://news.nationalgeographic.com/news/2015/01/150123-seabirds-mass-die-off- auklet-california-animals-environment>.

245. *Id.*

246. *Id.*

247. Morgan Eisenlord et al., *Ochre star mortality during the 2014 wasting disease pizootic: role of population size structure and temperature*, 371 PHIL. TRANSACTIONS OF THE ROYAL SOC’Y 2 (2016).

248. *India: 45 stranded whales die in Tamil Nadu*, BBC NEWS (Jan. 12, 2016), <http://www.bbc.com/news/world-asia-india-35289547>.

249. Ryan Schuessler, *Concerns mount over whale deaths in Gulf of Alaska*, WASH. POST (Aug. 24, 2015), <https://www.washingtonpost.com/news/energy-environment/wp/2015/08/24/concerns-mount-over-whale-deaths-in-gulf-of-alaska>.

250. Chelsea Harvey, *Scientists raise the alarm ‘unusual’ fur seal deaths off California coast*, WASH. POST (Sept. 29, 2015), https://www.washingtonpost.com/news/energy-environment/wp/2015/09/29/scientists-raise-the-alarm-over-unusual-fur-seal-deaths-off-california-coast/?utm_term=.72f00c4430a5.

coastlines is well-documented, and requires little elaboration. For polar bears, “climate warming is causing progressive unidirectional changes to sea ice distribution, structure, and patterns of breakup and freeze-up,” which is depriving them of the sea ice they need as a platform from which to hunt seals to maintain viable subpopulations in the wild.²⁵¹ Low genetic diversity, future loss of habitat, and reduced populations of some potential prey species could magnify the impact of current climate warming, posing a profound threat to polar bear survival.”²⁵² The story for Adelie Penguins is much the same, since polar, coastal and wetland ecosystems are especially vulnerable to climate change and are suffering some of the earliest impacts.²⁵³

Further from shore, there are other alarming reports suggesting the impacts of climate change are already well-underway for the world’s terrestrial wildlife. The plight of amphibians is one well-known example, including the sudden loss of more than 70% of all Central American amphibian species—which triggered some of the earliest alarm bells that a human-caused mass extinction was taking place.²⁵⁴ The likely cause of this mass amphibian die-off was a fungus widely hypothesized to have been enabled by minor changes in climate.²⁵⁵ The climate-disease connection is not confined to just amphibians in tropical climates. In fact, the spread of parasites and pathogens *out* of the tropics into colder-weather areas as those areas gradually warm presents some of the most dangerous possibilities

251. Ian Stirling & Andrew E. Derocher, *Effects of Climate Warming on Polar Bears: A Review of the Evidence*, 18 GLOBAL CLIMATE BIOLOGY 2694, 2704 (2012).

252. *Id.*

253. See OLEG A. ANISIMOV ET AL., *Polar regions (Arctic and Antarctic)*, in IPCC, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 653, 660 (Roger Berry et al. eds., 2007); Josef Settele et al., *Terrestrial and Inland Water Systems*, in CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY 299 (Fischlin et al. eds., 2014); Aaron Sidder, *Antarctica Could Lose Most of its Penguins to Climate Change*, NAT’L GEOGRAPHIC (June 29, 2016), <http://news.nationalgeographic.com/2016/06/adelie-penguins-antarctica-climate-change-population-decline-refugia/> (citing Megan A. Cimino et al., *Projected Asymmetric Response of Adelie Penguins to Antarctic Climate Change*, 6 SCI. REPS. 28785, 28785 (June 2016)).

254. Wake & Vredenburg, *supra* note 237, at 11472 (“Multiple factors acting synergistically are contributing to the loss of amphibians. But we can be sure that behind all of these activities is one weedy species, *Homo sapiens*, which has unwittingly achieved the ability to directly affect its own fate and that of most of the other species on this planet A primary message from the amphibians . . . is that little time remains to stave off mass extinctions, if it is possible at all.”); see also J. Alan Pounds et al., *Widespread Amphibian Extinctions from Epidemic Disease Driven by Global Warming*, 439 NATURE 161, 161 (2006).

255. Brian Handwerk, *Frog Extinctions Linked to Global Warming*, NAT’L GEOGRAPHIC (Jan. 12, 2006), http://news.nationalgeographic.com/news/2006/01/0112_060112_frog_climate.html (“Disease is the bullet killing frogs, but climate change is pulling the trigger”).

or threats to wildlife, humans, and domestic animals who have not developed an immune response.²⁵⁶ Pathogens currently on the march into new territories, with the aid of climate change, include Lyme disease²⁵⁷ and Bubonic plague.²⁵⁸

The most notable of recent upland mass mortality events was the death of more than 200,000 endangered Saiga Antelope in Central Asia in the spring of 2015.²⁵⁹ The deaths had scientists puzzled for months, until they discovered that a slight increase in average temperature attributed to climate change had transformed normally harmless gut microbes into a deadly bacteria that decimated the population.²⁶⁰ The mass death of these animals, and the relatively small shift in temperature necessary to transform harmless microbes into a widespread mortality vector, is a frightening example of how the world's wildlife populations may be far more vulnerable to small, indirect impacts of climate change than originally thought, and that the loss of such wildlife from climate change is occurring much sooner than anticipated.

These recent mass marine and terrestrial die-offs are consistent with a 2015 study from a team of researchers at Yale, Berkeley, Dartmouth, and other universities finding recent shifts in the frequency, magnitude, and cause of mass

256. Lydden Polley, Eric Hoberg & Susan Kutz, *Climate Change, Parasites and Shifting Boundaries*, 52 ACTA VETERINARIA SCANDINAVICA 1 (2010).

257. See Nicholas H. Ogden et al., *Risk Maps for Range Expansion of the Lyme Disease Vector, Ixodes scapularis, in Canada Now and with Climate Change*, 7 INT'L J. HEALTH GEOGRAPHICS 1, 2 (2008), <https://ijhealthgeographics.biomedcentral.com/articles/10.1186/1476-072X-7-24> (“Lyme disease is an emerging infectious disease in Canada, largely due to the expansion of the geographic range of the tick vector *Ixodes scapularis* in eastern and central Canada. Up to 1997, the only population of *I. scapularis* known in Canada was that at Long Point, Ontario. However, the number of known *I. scapularis* populations in Canada has risen from 1 to 13 in the last decade, a period that may have witnessed the first evidence of global warming. Global warming is anticipated to accelerate expansion of the geographic range of *I. scapularis* into Canada, provided that suitable habitat and hosts occur, and may influence the emergence of tick-borne zoonoses.”).

258. Nils Stenseth et al., *Plague Dynamics are Driven by Climate Variation*, 103 PROC. NAT'L ACAD. SCI. 13110, 13110 (2006) (“A 1°C increase in spring is predicted to lead to a >50% increase in prevalence. Climatic conditions favoring plague apparently existed in this region at the onset of the Black Death as well as when the most recent plague pandemic arose in the same region, and they are expected to continue or become more favorable as a result of climate change. Threats of outbreaks may thus be increasing where humans live in close contact with rodents and fleas (or other wildlife) harboring endemic plague.”).

259. Carl Zimmer, *More Than Half of Entire Species of Saigas Gone in Mysterious Die-Off*, N.Y. TIMES (Nov. 2 2015), http://www.nytimes.com/2015/11/03/science/more-than-half-entire-species-of-saigas-gone-in-mysterious-die-off.html?_r=0.

260. *Id.*

mortality events for wildlife across the globe.²⁶¹ Defining mass mortality events as those that result in the death of 90% of a population, more than a billion individuals, or 700 or more tons of dead biomass, the study looked at more than 700 such events since 1940.²⁶² The study concluded that, overall, “fishes were the largest contributor of reported MMEs,” and that mass mortality events are “increasing in frequency and—for birds, fishes, and marine invertebrates—in severity as well.”²⁶³ The study recommended additional analysis of such mass death events among wildlife populations “because the severity of extreme weather-related events such as heat waves, heavy precipitation, and drought is expected to increase in the future as a result of climate change.”²⁶⁴

The actual level of mortality for all wildlife populations from climate change will be closely tied to each population’s capacity to migrate in order to stay within tolerable conditions. Examples already abound of species substantially shifting their range as average temperatures rise—in fact, “modern climate change is reshuffling the geographic distributions of plant and animal species world-wide.”²⁶⁵ Conversely, those species that are isolated on literal or figurative islands are in trouble. “Islands” can be natural topographical features—that is, actual islands, or high-altitude mountain peaks with no connectivity at the same elevation. They can also be created by humans, including habitat fragmented by human land use (roads, lumber, agriculture), border walls, and legal protections that are limited to circumscribed geographic areas that lack protected migration corridors.²⁶⁶

261. See generally Samuel Fey et al., *Recent Shifts in the Occurrence, Cause, and Magnitude of Animal Mass Mortality Events*, 4 PROC. NAT’L ACAD. SCIS. 1083, 1083–88 (2015).

262. See *id.* at 1083.

263. *Id.* at 1084.

264. *Id.* at 1083.

265. Arent Hampe & Remy J. Petit, *Conserving Biodiversity Under Climate Change: The Rear Edge Matters*, 8 ECOLOGY LETTERS 461, 461 (2005); Camille Parmesan & Gary Yohe, *A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems*, 421 NATURE 37, 42 (2003) (“Global meta-analyses documented significant range shifts averaging 6.1 km per decade towards the poles”).

266. See Yadvinder Malhi et al., *Climate Change, Deforestation, and the Fate of the Amazon*, 319 SCI. 169, 172 (2008) (describing how human-driven deforestation exacerbates the biodiversity loss caused by climate change by cutting off migration corridors); Thomas E. Lovejoy, *Biodiversity: What Is it?*, in BIODIVERSITY II: UNDERSTANDING AND PROTECTING OUR BIOLOGICAL RESOURCES 12 (Marjorie L. Kudla et al. eds., 1997) (“Today, most biodiversity . . . is locked up in isolated patches. In the face of climactic change . . . human activity has created an obstacle course for the dispersal of biodiversity. This could establish one of the greatest biotic crises of all time.”).

All of this uncertainty makes prediction and quantification of wildlife loss from climate change a necessarily inexact science. A 2004 estimate in *Nature* found that, under pessimistic assumptions about adaptability, 22–31% of species would be irreversibly on the path to extinction by 2050 if warming were kept to a minimum, and 38–52% if it were allowed to increase.²⁶⁷ Under optimistic assumptions, the ranges were 9–13% at low warming and 21–32% at high warming. The average it extrapolated was 24% of all species would be headed for extinction by 2050.²⁶⁸

A 2015 meta-analysis—widely regarded as the most up to date and conservative estimate of species loss from climate change—noted that “current predictions about extinction risks vary widely, suggesting anywhere from 0 to 54% of species could become extinct from climate change.”²⁶⁹ After synthesizing all existing studies on the topic, the meta-analysis concluded that 5.2% of species will go extinct at the global policy target of 2 degrees Celsius (now widely regarded as unobtainable); 8.5% at 3 degrees Celsius; and 16% (or one in six) at the current “business as usual” trajectory.²⁷⁰ But the rate of loss was non-linear between different areas of the world. North America and Europe returned the lowest numbers at 5% and 6% respectively whereas South America faces a whopping 23% loss prediction and Australia and New Zealand falling in between at 14%.²⁷¹

The situation is equally grim for domestic animals and climate change. So far this discussion has focused on wild animal impacts, rather than the impacts of climate change upon domestic animals—an omission that is not driven by an indifference to the plight of domestic animals, nor any inherent valuation of wild animals over captives. Rather, this particular class of impacts is so poorly studied and understood as to make analysis or prediction almost impossible. Here again, there is ample room—and a pressing need—for additional research. Nevertheless, a few issues are worth noting.

First, all of the increased risks to people and wildlife discussed in this paper are closely related to the risks presented to companion and captive animals. As the

267. Chris D. Thomas et al., *Extinction Risk from Climate Change*, 427 NATURE 145, 148 (2004).

268. *Id.*

269. Mark C. Urban, *Accelerating Extinction Risk from Climate Change*, 348 SCI. 571, 573 (2015).

270. *Id.*

271. *Id.*

United States Geological Survey has explained, “[i]t is impossible to separate the effects of global warming on wildlife from its effects on the health of domestic animals and people.”²⁷² This is particularly true with regard to the role of climate change in fostering the expansion and transmission of zoonotic diseases, like Lyme and West Nile.²⁷³ It is well-documented that climate change is already increasing the disease risks for companion animals, including dogs and cats²⁷⁴ as well as horses.²⁷⁵ This increased risk of disease and parasite transmission is also an issue for farmed animals and animals in zoos and other public displays.²⁷⁶

Domesticated and other captive animals also face the same threats from extreme weather, heat waves, floods, hurricanes, and drought as vulnerable populations of humans. These animals are particularly at risk because the focus of both prevention and response to disasters is primarily upon people.²⁷⁷ As

272. U.S. GEOLOGICAL SURV., CLIMATE CHANGE AND WILDLIFE HEALTH: DIRECT AND INDIRECT EFFECTS I (2012).

273. *Id.*

274. Colleen L. Lau et al., *Climate Change, Flooding, Urbanization and Leptospirosis: Fueling the Fire?*, 104 TRANSACTIONS ROYAL SOC’Y TROPICAL MED. & HYGIENE 631, 631 (2010) (“With global climate change, extreme weather events such as cyclones and floods are expected to occur with increasing frequency and greater intensity and may potentially result in an upsurge in the disease incidence as well as the magnitude of leptospirosis outbreaks.”); *Climate Change and Pets: More Fleas, More Heartworm*, CHI. TRIB. (Feb. 3, 2016), <http://www.chicagotribune.com/lifestyles/pets/ct-climate-change-affects-pets-20160203-story.html> (Fleas and ticks “are most active in warm months, but with cities in the Northeast and Midwest setting record highs this past December, calendars no longer offer guidance on when pet owners should worry and when they can relax.”); CARE2, *3 Ways Climate Change Impacts our Pets*, ECOWATCH (Feb. 20, 2016), <http://www.ecowatch.com/community/care2> (“Heartworm used to mainly be a problem in the southern part of the U.S., for example, but now it’s an issue in all 50 states thanks to the mosquito’s expanding habitat.”).

275. Melissa A. Rebbeck, *The Impact of Climate Change on Horses, and Horse Industries: Some Gaps and Opportunities Identified Using Available Literature*, S. AUSTRAL. RES. & DEV. INST.: CLIMATE APPLICATIONS 1 (2013); Sue M. Copeland, *Climate Threat?*, HORSE & RIDER 57 (2015).

276. U.S. EPA, CLIMATE IMPACTS ON AGRIC. AND FOOD SUPPLY (2016) (“Climate change may increase the prevalence of parasites and diseases that affect livestock. The earlier onset of spring and warmer winters could allow some parasites and pathogens to survive more easily. In areas with increased rainfall, moisture-reliant pathogens could thrive.”); Andres Barbosa, *The Role of Zoos and Aquariums in Research into the Effects of Climate Change on Animal Health*, 43 INT’L ZOO Y.B. 131, 131 (2009) (“There are 118 transmissible diseases affecting zoos animals reported . . . and 29 of these can be identified as likely to be affected by climate change”).

277. Lisa K. Zottarelli, *Broken Bond: Exploration of Human Factors Associated with Companion Animal Loss During Hurricane Katrina*, 25 SOCIOLOGICAL F. 110, 120 (2010) (“Companion and service animals are viewed as property and, therefore, have had a secondary or lower place in disaster planning. With a few notable exceptions, horses, cattle, and large and

discussed above in relation to Hurricane Katrina, this can be extremely problematic for people as well, since the failure to plan for the evacuation of family pets can and does cause many people to stay in the crosshairs of a coming disaster, and perish as a result, due to their unwillingness to abandon their animals.²⁷⁸ As explained by one researcher, “treating humans and animals as separate could undermine the success of emergency–preparedness in public health campaigns seeking to improve planning, evacuation, and survival among animal owners and care[take]rs.”²⁷⁹

Like other climate–caused disasters for people and wildlife, the death tolls can be staggering. In one of the few works that attempts to catalog the effects of natural disasters on animals, Leslie Irvine explains that in 1999 “Hurricane Floyd followed closely behind Hurricane Dennis. Together, the storms caused widespread flooding in eastern North Carolina that killed nearly three million animals.”²⁸⁰ As explained by Irvine, the prevalence of companion animals in American homes means that “for every 1000 households affected by a disaster, approximately 1500 animals will also be involved.”²⁸¹

Here again, the lessons from Hurricane Katrina are illustrative of what is likely coming as the incidence of hurricanes and other weather–related disasters increases due to climate change. As discussed above, 250,000 companion animals perished or were displaced during this single hurricane event.²⁸² What is less known is the massive additional death toll upon farmed animals, research animals, and animals in public display facilities. Katrina killed 8,000 animals at Louisiana State University’s Health Sciences Center School of Medicine, including dogs

agribusiness animals continue to be overlooked in disaster planning and are absent from disaster research.”).

278. Kirrilly Thompson, *Save Me, Save My Dog: Increasing Natural Disaster Preparedness and Survival by Addressing Human–Animal Relationships*, 40 AUSTL J. COMM. 123 (2013) (“Taking advantage of human attachments to animals and pets is essential, given increasing rates of pet ownership and increasing incidence of extreme weather events attributed to climate change.”).

279. *Id.* at 130–131 (“More than 8% of fatalities from the Australian flood data . . . resulted from people’s attempts to save “stocks, property, or pets” —even when the animal or pet was not their own.”).

280. LESLIE IRVINE, *FILLING THE ARK: ANIMAL WELFARE IN DISASTERS* 8 (2009).

281. *Id.* at 34 (“Surveys by the American Veterinary Medical Association indicate that 70 percent of U.S. households include dogs and cats. Add in birds and horses, and the figure surpasses 75 percent . . . Moreover, 60 percent of households with companion animals include multiple animals.”).

282. Bershadker, *supra* note 8686 and accompanying text.

and monkeys.²⁸³ At the New Orleans Aquarium, more than 10,000 fish were killed when the facility lost power and the staff evacuated, leaving thousands of animals behind.²⁸⁴ The situation for farmed animals was even more problematic. Although millions of animals perished, perhaps the worst single incident was at Sanderson Farms in Mississippi, where “[t]he company estimates that three million broiler chickens died because of Katrina.”²⁸⁵

These levels of domestic animal death from extreme weather events are not uncommon. In 2000, a similar fate befell the egg-laying hens at Buckeye farm in Ohio, where tornadoes ripped through a number of sheds and resulted in the death of more than 500,000 birds, many of whom “trapped alive in their cages, were crushed to death or buried alive.”²⁸⁶ What is uncommon is the degree to which climate change is thought to be increasing both the frequency and intensity of hurricanes, heat waves, and other extreme weather events that cause mass mortality of companion and captive animals.²⁸⁷ Because of the huge number of food animals in the United States, and their close confinement within factory farm conditions, they are prime targets for mass mortality events triggered by extreme weather.

An increased prevalence of wildfires from climate change will also leave domestic animals hard-hit. The Australian wildfire of 2009 killed approximately a million animals, including farmed animals, captive wildlife, and companion animals.²⁸⁸ Major wildfire events have caused mass mortality of animals in the United States, including recent fires in New Mexico, Colorado, and California.²⁸⁹

283. IRVINE, *supra* note 280, at 84–85.

284. *Katrina Kills Most Fish in New Orleans Aquarium*, CNN (Sept. 9, 2005), <http://www.cnn.com/2005/TECH/science/09/07/katrina.zoos/>.

285. IRVINE, *supra* note 280, at 45.

286. *Id.* at 51.

287. Indeed, there was nothing uniquely fatal for domestic animals about Hurricane Katrina. In 2001, Tropical Storm Allison killed over 35,000 animals at the Texas Medical Center, while the Center for Laboratory Animal Medicine and Care of the University of Texas Health Science Center reportedly lost “78 primates, 35 dogs, 300 rabbits, and thousands of mice . . . bringing the number of animal deaths to approximately 5000.” *Id.* at 89.

288. INT’L FUND FOR ANIMAL WELFARE, UNNATURAL DISASTERS: THE IMPACTS OF CLIMATE-RELATED EMERGENCIES ON WILDLIFE, LIVESTOCK, AND COMPANION ANIMALS, http://www.ifaw.org/sites/default/files/unnatural_disasters_0.pdf (last visited Jan. 26, 2017).

289. *BREAKING: ASPCA Responders Help Animals Displaced by Devastating Fire in New Mexico*, AM. SOC’Y PREVENTION CRUELTY ANIMALS (June 23, 2016); *UPDATE: ASPCA Assists LCACC in Providing Support for Hundreds of Animals, Pet Parents Following Devastating CA Wildfire*, AM. SOC’Y FOR THE PREVENTION OF CRUELTY TO ANIMALS, (Sept. 22, 2015); Malinda

The same holds true for the increased frequency and intensity of heat wave events, which are already severely impacting both companion and agricultural animals.²⁹⁰

The issue of increasing extreme heat events could prove particularly problematic for domestic animals, as it could lead to across-the-board policy changes that roll back decades of progress concerning the humane housing and care of farmed animals, animals bred for pets, and those kept in zoos and other public displays. Over the last decade, great progress has been made in changing federal, state, and local animal protection laws and regulations to provide additional housing space and outdoor access for captive animals. For example, dozens of states currently require dog breeding facilities to provide some form of outdoor access for dogs. Efforts to replicate such requirements in other states will become more and more difficult in the face of increasing incidents of excessive heat and other extreme weather conditions from climate change, and many of the existing humane housing laws may be repealed or modified.

The same problem pertains to zoo and circus animals. For example, USDA policy provides that the required “adequate freedom of movement” for animals in traveling acts can be met by regularly turning animals outside into “a secure space, such as a ring or corral, that provides the opportunity for species-appropriate exercise.”²⁹¹ An increase in extreme heat events could trigger policy

Larkin, *Colorado Fires Cause Mass Evacuations*, J. AM. VETERINARY MED. ASS’N NEWS (Aug. 1, 2012).

290. See Elizabeth Fields, *Dogs at Shelter Died of Heat Stroke, Owners Demanding More Answers*, WSPD LOCAL 6 (June 25, 2014, 11:10 PM), <http://www.wpsdlocal6.com/story/25873759/dogs-at-shelter-died-of-heat-stroke-owners-demanding-more-answers>; Marianne Brown, *Dallas-Fort Worth Seeing Heat-Related Deaths of Strays, Pets*, DALLAS MORNING NEWS (July 29, 2011, 11:52 AM) <http://www.dallasnews.com/news/news/2011/07/29/dallas-fort-worth-seeing-heat-related-deaths-of-strays-pets> (“Animal control units across Dallas-Fort Worth are seeing heat-related deaths in both strays and pets. Grand Prairie animal control responded to 25 heat-related dog deaths over the past 25 days.”); U.S. EPA, CLIMATE IMPACTS ON AGRICULTURE AND FOOD SUPPLY (Oct. 2016), <https://www.epa.gov/climate-impacts/climate-impacts-agriculture-and-food-supply> (“Heat waves, which are projected to increase under climate change, could directly threaten livestock. A number of states have each reported losses of more than 5,000 animals from just one heat wave.”); U.S. DEP’T AGRIC. U.S. CLIMATE CHANGE SCIENCE PROGRAM, THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE, LAND RESOURCES, WATER RESOURCES, AND BIODIVERSITY IN THE UNITED STATES 2 (May 2008), http://www.usda.gov/oce/climate_change/SAP4_3/CCSPFinalReport.pdf.

291. U.S. DEP’T OF AGRIC. ANIMAL CARE POLICY MANUAL, ANIMAL CARE 6.2 (May 23, 2016), https://www.aphis.usda.gov/animal_welfare/downloads/Animal%20Care%20Policy%20Manual.pdf.

changes that would force millions of companion breeding and captive performing animals into indoor-only enclosures—which are widely regarded as significantly less humane than facilities with outdoor access.

The situation is particularly worrisome with regard to farmed animals and heat. Although much of the last decade of advocacy for farm animal welfare has focused on converting facilities from intensive cage confinement systems to more open, but still enclosed, operations, this battle has essentially been won through a combination of legislative, legal, and consumer strategies.²⁹² An additional push urging outdoor access for farmed animals has been gaining ground, and was recently incorporated into the revised USDA organic food labeling regulations proposed in July of 2016.²⁹³ As extreme weather events become more prevalent, it is likely that indoor controlled environments will be touted as a humane approach to “protecting” farmed animals from weather extremes, making it even more difficult to effect positive welfare changes for such animals.

The USDA and agricultural research centers are already beginning to make suggestions along these lines, noting that “climate change and associated variation in weather patterns will likely result in more livestock being managed in or near facilities that have capabilities for imposing microclimate modifications.”²⁹⁴ However, any increase in confinement or the concentration of farmed animals is likely to make it even more difficult to rescue animals, and for them to escape in the event of flooding or fires.²⁹⁵

In short, climate change is already having a massive impact on billions of wild and domestic animals. These impacts are manifesting faster in the animal community than any other place on the globe due to the limited ability of animals

292. *See, e.g.*, Engber, *supra* note 224; PACELLE, *supra* note 29.

293. Organic Livestock and Poultry Practices, 81 Fed. Reg. 21,956 (Proposed Apr. 13, 2016) (to be codified at 7 CFR pt. 205).

294. U.S. DEP’T AGRIC. U.S. CLIMATE CHANGE SCIENCE PROGRAM, THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURE, LAND RESOURCES, WATER RESOURCES, AND BIODIVERSITY IN THE UNITED STATES 67 (May 2008), http://www.usda.gov/oce/climate_change/SAP4_3/CCSPFinalReport.pdf (discussing the impacts of climate change on rangelands and noting that “climate change and associated variation in weather patterns will likely result in more livestock being managed in or near facilities that have capabilities for imposing microclimate modifications.”).

295. IRVINE, *supra* note 280, at 9 (noting that “[w]hen Hurricane Floyd struck, an estimated 237 hog CAFOs were located on floodplains of eastern North Carolina. Following the hurricane, tens of thousands of hogs drowned in CAFOs, and their carcasses washed into coastal rivers” and that the “solution lies in changing the practices of factory farming so that animals, and the humans who share their environment, are less vulnerable.”).

to adapt and because of the large number of individuals and species that depend on an ocean environment that is currently taking the brunt of more than 90% of the warming energy caused by GHG emissions. The impacts are not limited to wildlife or marine species but are already being felt by virtually all animals, including family pets, captive display animals, research animals, and farmed animals. As climate change continues to increase the incidence of extreme flooding and heat events, not only will the loss of animal life increase exponentially, but the ability of animal advocates to press for less confining, outdoor housing of agricultural and other commercial animals is likely to be severely compromised. There is already more than enough evidence that climate change will cause a degree of suffering and death that far outstrips many if not all of the practices and uses of animals that the animal protection community is currently focused on. As is the case for advocates concerned with poverty and public health, civil rights, women's rights, child protection, and the plight of refugees, animal advocates proceeding in ignorance of the frightening reality of climate change are ignoring perhaps the biggest threat to their constituents in modern human history.

IV. FORGING NEW ALLIANCES IN THE FIGHT AGAINST CLIMATE CHANGE

At the opening of this paper, I proposed to explore solutions to some of the major obstacles to effective climate emission control efforts over the course of this two-part series of papers. The first was the widespread view that climate change is a narrow special-interest issue for environmental advocates and the resulting disengagement of a large number of people and organizations that have as much—or more—to lose from unmitigated climate change than environmentalists.

The solution to the first problem seems clear. As discussed herein, there is more than enough evidence to change the public debate over climate change to resonate with ordinary people that do not self-identify as environmentalists. But, to do so, climate change advocates will have to fundamentally shift the discussion of climate change impacts from facts and figures about sea level rise and mean temperature to concrete numbers about mortality and suffering of *individuals lives* within the most vulnerable quarters of society.

To achieve this, we need not descend into the debate over the virtues and vices of identity-based politics in America generally, or in the climate change

arena in particular.²⁹⁶ The fact of the matter is that—good or bad—the entire political and non-profit community as well as public interest legal disciplines taught in U.S. law schools are all organized around and deeply entrenched within an identity-based structure. Shifting the way in which we discuss climate change to resonate with the existing identity-based political and legal structure does not require that we endorse it, nor that we ignore the intersectional nature of the problem at hand. But it is crucial that climate advocates engage with it in order to counteract the prevailing public view that climate change is an abstract scientific problem, rather than a social problem that has devastating and far-reaching effects on constituencies people care about—human, environmental, and animal.

The case must be made that the impacts of climate change affect a number of public and private interests—with particular attention to the connection between climate change and social justice. How many people know that heat wave deaths will surpass gun violence within 15 years? Or that some 20,000,000 Americans (mostly the poor and people of color) will have to pick up and move to higher ground, without the benefit of government financial or logistical help, during this same timeframe? How many know that people of color are *less* culpable in the creation of climate change, and yet will be victimized *more* by its effects because of the color of their skin? How many are aware that climate change will be responsible for the death of billions of wild animals due to our blind negligence concerning the impacts of GHG emissions? Among those few that have heard these predictions, how many have actually internalized them, or are operating in a state of denial?

More precise polling could answer some of these questions, but one thing is clear—redefining climate change as an overarching social justice issue costing large numbers of individual lives of interest to multiple public interest causes is absolutely essential for this problem to transcend its traditional status as an esoteric environmental theory and build an effective and unified agenda to address climate emissions. Once traditional climate advocates have expanded their own thinking about the scope of climate change risks, that improved model can be deployed with other public interest causes, many of which are disengaged

²⁹⁶ See, e.g., Ana-Maria Bliuc et al., *Public Division About Climate Change Rooted in Conflicting Socio-Political Identities*, 5 NATURE CLIMATE CHANGE 226 (2015); Jason G. Goldman, *Climate Change Divide is About Group Identity, Not Politics*, CONSERVATION THIS WEEK (Feb. 4, 2015), <http://conservationmagazine.org/2015/02/climate-change-divide-is-about-group-identity-not-politics/>.

from the looming threat climate change poses to their constituents. But where to start this process of redefinition, unification, and expansion?

One obvious first step is to activate the animal protection community on the issue of climate change. Although every major animal protection group acknowledges and decries the impact of climate change, little of the movement's financial resources are being devoted to either curbing climate emissions or preparing for climate-caused natural disasters. As discussed above, one possible reason for this disconnect is the prevailing language of climate change within the environmental community.

Couched in the environmental language of "species loss," the current science on climate change and its impacts on animals simply fails to resonate outside the enclosed circle of environmental advocates and sympathizers. It requires little imagination to see how hampered discussions of human climate change impacts would be if impacts on public health were described based on the percentage of human diseases that would be increased in prevalence, or the percentage of cities that will experience increased incidents of heat stroke—rather than concrete predictions of the number of individual persons suffering infection or death. This fundamental disconnect between how we discuss climate impacts on humans versus animals (individuals vs. species) not only masks the full impact of climate change, it also leaves by the side of the road a vast number of potential climate change advocates who are more concerned with the death and destruction of billions of individual animal lives than even a large decline in biodiversity.

To make matters worse, the current language of species loss is failing to capture a massive amount of wildlife death from climate change that does not rise to the level of extirpating an entire species. Thus, as explained by Professor Urban in his recent meta-analysis of the risks of species loss, his analysis, like all studies of climate-induced wildlife loss, generated figures that "are much smaller than the total number of species influenced by climate change."²⁹⁷ As Urban notes, "species not threatened directly with extinction could experience substantial changes in abundance, distributions, and species interactions that could affect human ecosystems."²⁹⁸ This is consistent with the recent study of mass wildlife

297. Mark C. Urban, *Accelerating Extinction Risk from Climate Change*, 348 *SCIENCE* 571, 573 (2015).

298. *Id.*

mortality events discussed above, which notes that massive death events—on the order of billions of animals—regularly occur *without* triggering extirpation.²⁹⁹

In other words, when it comes to animal mortality and climate change, a huge component of the total death toll and suffering is being left on the table using the current methods of studying and speaking about impacts on a species-loss basis. So why not translate the relatively extensive knowledge base on climate change from the abstract language of scientific biodiversity to the more familiar language of actual lives lost? The answer, unfortunately, is that there currently exists little reliable data or studies to form the basis for such a translation.³⁰⁰ But there is one potential exception—birds.

In a tradition dating back to John James Audubon, both total bird species and population numbers have been better studied and tracked than any other taxon for more than a century. Based on this data, there is a single study—conducted by Professors Gaston and Blackburn in the United Kingdom—that sought to estimate the total number of individual birds on a world-wide basis. In their unique article, Gaston and Blackburn lament the lack of attention to total individual numbers of animals in the conservation literature. As the authors note:

Although attention has been focused on species richness there are other dimensions to global biodiversity which are at least as poorly known, may perhaps be just as important to quantify, and about which the failure to quantify may be equally lamentable. The total number of individual organisms in the world, for example, has been a largely ignored statistic. Nonetheless, just as the species, the individual is regularly identified as a level in hierarchical schemes of the components of biodiversity. Indeed, it is one of the few entities that is frequently represented in more than one hierarchy in

299. Samuel B. Fey et al., *Recent Shifts in the Occurrence, Cause, and Magnitude of Animal Mass Mortality Events*, 112 PROC. NAT'L ACAD. SCI. 1083, 1083 (2015).

300. There are relatively reliable estimates of the number of individual polar bears and penguins that are likely to be killed due to climate change. This is also the case for many species currently on the “Red List” maintained by the International Union for Conservation for Nature. But even adding up all of these species would only provide a tiny fraction of the total loss of wildlife from climate change, not only because the list contains so few of the total species of the world, but also because the species listed therein are already so drastically reduced in size as to provide an incomplete picture of the likely loss of wild animal life from climate change. For an interesting exploration of the potential financial cost of the loss of currently listed threatened and endangered species from climate change, see Wayne Hsiung & Cass R. Sunstein, *Climate Change and Animals*, 155 U. PA. L. REV. 1695 (2007) (applying contingent valuation theory to conclude that the loss of imperiled species from climate change “might run into the hundreds of billions of dollars annually”).

schemes that recognize multiple hierarchies of biodiversity (e.g. genetic, organismal and ecological diversity). *If, as some have maintained, no level of biodiversity is any more fundamental than any other, then it would seem as essential to ask about global numbers of individuals as about global numbers of species.*³⁰¹

Seeking to fill this void, the authors used four different methods to calculate the total number of land and sea birds on a global basis. The result was an estimated “global bird population of between 200 and 400 billion.”³⁰² Using habitat density modeling, the authors concluded that for every removal of “1% of the land area of the planet to support birds (through habitat destruction, urbanization, etc.),” the net result is the loss of 2.5 billion individual birds—or roughly the total peak population size of the now extinct Passenger Pigeon.³⁰³

Deploying Gaston and Blackburn’s work to construct a reliable prediction of total individual bird loss based on Urban’s various models for percentage of species loss due to climate change is difficult for a number of reasons already discussed. Most notably, the massive number of individual birds that can (and will) be killed without causing the loss of any particular species, and the fact that individual population size within various bird species is non-linear. However, some calculation is sorely needed in current climate change literature and by extension in climate change advocacy.

Based on Urban's extinction meta-analysis, the “business as usual” climate scenario would result in a species extinction risk of 15.7%.³⁰⁴ If the international climate policy goal of holding post-industrial temperature increases to 2 degrees Celsius is met, Urban's model puts the species extinction risk at 5.2%.³⁰⁵ These risk figures are not dependent on taxonomic group. To crudely and conservatively estimate the loss of individual animals, one could compare the middle range of Professor Gaston’s estimate for the global bird population, 300 billion, with the number of known bird species, approximately 9,956, and calculate an average number of approximately 30,000,000 individuals per avian species. Applying

301. Kevin J. Gaston & Tim M. Blackburn, *How Many Birds Are There?*, 6 BIODIVERSITY & CONSERVATION 615, 616 (1997) (emphasis added) (noting that “the number of individual organisms would actually seem more amenable to assessment than the number of species” due to a number of common problems with classifying species).

302. *Id.* at 615.

303. *Id.* at 622.

304. *See* Urban, *supra* note 270, at 571–73.

305. *Id.*

Urban's "business as usual" extinction rate of 15.7%, the result would be the extinction of 1,563 bird species, or 47 billion individual birds. If existing climate emission control efforts manage to hit the 2-degree goal, 5.2% of bird species would face extinction, resulting in the death of 15.6 billion birds. Thus, taking action to meet international climate change targets could save the lives of approximately 30 billion birds.³⁰⁶

According to another study, the total number of individual terrestrial mammals is potentially 2.25 times the total number of individual birds,³⁰⁷ which using Gaston's middle estimate of 300 billion birds would yield a rough total of 687 billion individual mammals. Individual fish are thought to outnumber both birds and land mammals by several orders of magnitude. Assuming consistent extinction risks between mammals and birds, Urban's analysis would yield approximately 100 billion mammal deaths under "business as usual" emission levels, and 33 billion mammal deaths if international emissions targets are met. Thus, meeting the international goal of holding temperature increases to 2 degrees could save the lives of some 66 billion mammals.

Altogether, and without taking into account the non-linearity of species population size and the reality of mass mortality without extirpation, one could project a total estimate of individual bird and mammal lives lost from climate change of approximately 147,000,000,000, and a corresponding potential to save more than 100,000,000,000 birds and mammals by hitting the international warming goal of 2 degrees. This 147 billion figure is beyond speculative,³⁰⁸ but

306. These rough calculations use average extinction rates, and also make the simplifying assumption that a given percentage loss of species will result in the same percentage loss of individuals. Since extinction will likely disproportionately affect species with smaller rather than larger populations, these figures may overestimate the percentage of individual animal deaths from extinction. However, the use of average extinction rates and uniform population size assumptions seems reasonable for the purposes of the preliminary calculations herein, especially since the calculations also dramatically underestimate total mortality by only counting animal deaths from climate change where entire species are extirpated, and do not take into account the much higher number of animals that will be killed by climate change at a sub-extinction level. *See* Urban, *supra* note 297; Fey, *supra* note 299; Professor Kevin J. Gaston, Personal Communication, Aug. 17, 2016 ("very large numbers of individuals of common species will tend to be lost for every rare species that is extirpated").

307. Gaverick Matheny & Kai M. A. Chan, *Human Diets and Animal Welfare: The Illogic of the Larder*, 18 J. AGRIC. & ENVTL. ETHICS 579, 585 (2005).

308. This paper is not asserting that 147 billion birds and mammals *will in fact* be killed by climate change. In all likelihood the number could be much larger. *See* Gaston & Blackburn, *supra* note 301, at 618. This figure is included in the discussion to give a rough sense of the magnitude

also beyond staggering when compared to other causes of animal suffering and death that are currently the focus of animal advocates, including the roughly 100,000 animals killed in African trophy hunts each year,³⁰⁹ the approximately 100 million used in animal research,³¹⁰ the 2.25 million used in lawful international trade (and 100 million or more in illegal trafficking),³¹¹ the 3–4 million animals killed by the U.S. Department of Agriculture’s “Wildlife Services” animal damage control program,³¹² and the 57 million mink and foxes killed for fur worldwide.³¹³ Indeed, the only source of animal suffering and death that is even remotely in the same class as climate change is factory farming, which ironically is both a cause of direct suffering for billions of confined animals, and also a significant cause of climate change emissions that are likely to kill billions of wild animals—a double header of misery.

In short, there is a dire need for additional attention to the question of quantification of animal mortality resulting from climate change. There is nothing inherently wrong in valuing the preservation of species as a whole, nor in lamenting the loss of wildlife on a species-wide level. Doing so is consistent with the general propensity for modern environmentalism to speak in terms of populations or species rather than individuals or lives. But it ignores to some extent, or at least fails to fully describe the impact of climate change in a way that resonates with animal advocates, the general public, and many environmentalists themselves—who are equally or more concerned with the death and destruction of billions of individual animal lives. If climate impacts were quantified on a per-animal lost basis, these largely dormant constituencies could be much more active on climate issues, and much more likely to support policies to control climate emissions.

of death and suffering at issue, and to highlight the pressing need for further research to develop a reliable quantitative analysis on this question.

309. P.A. Lindsey et al., *Economic and Conservation Significance of the Trophy Hunting Industry in Sub-Saharan Africa*, 134 *BIOLOGICAL CONSERVATION* 455, 459 (2006).

310. Katy Taylor et al., *Estimates for Worldwide Laboratory Animal Use in 2005*, 36 *ALTERNATIVES LABORATORY ANIMALS* 327, 327 (2008).

311. U.N. ENVIRONMENTAL PROGRAM, *Analysis of the Environmental Impacts of Illegal Trade In Wildlife* (Undated Working Paper), http://www.unep.org/about/sgb/Portals/50153/UNEA/FINAL_%20UNEA2_Inf%20doc%2028.

312. U.S. DEP’T OF AGRIC., *Animals Dispersed / Killed or Euthanized / Freed* (2015), https://www.aphis.usda.gov/wildlife_damage/pdr/PDR-G_Report.php.

313. Andrey Kolokolnikov, *International Fur Trade: Trends, Challenges, Prospects* (Mar. 18, 2013) (unpublished B.A. Business thesis, Helsinki Metropolia University of Applied Science) (on file with GEO. ENVTL. L. REV.).

Another key strategy for expanding and diversifying the fight against climate change is reactivating the old alliance between the animal protection and environmental communities. The idea being that if we cannot find and hold common ground between these frequent policy partners on climate change, what hope do we have for enlisting other, more diverse, voices in this debate. These two movements are both grounded in a deep respect for the intrinsic value of life—both flora and fauna—which is why their cooperation is a key element in building a unified, multidisciplinary effort to tackle the common enemy of unmitigated climate change.

The environmental and animal welfare movements have long shared many common values, common staff, membership, and campaign priorities and victories. For most of the 20th Century, campaigns to protect the environment for the purpose of biodiversity and for the sake of the intrinsic value of animals proceeded hand in hand. From early wildlife protection, to toxic air and water pollution, to the overuse of non-therapeutic antibiotics, animal and conservation groups have fought and won numerous legislative, regulatory and legal battles in cooperation. It was public outrage over the mass-killings of animals that triggered federal legislative intervention in wildlife policy at the beginning of the 20th Century—an arena traditionally left to the individual states.³¹⁴

Thus, from at least the enactment of the Migratory Bird Treaty Act of 1918,³¹⁵ animal welfare and environmentalism not only proceeded in tandem and cooperation in U.S. policy, but have achieved success largely by relying on the public's deep concern for the plight of individual animals. Thus, while there are references to preserving food supply in both the MBTA legislative history and the underlying treaties,³¹⁶ the driving force behind its enactment was the public's outrage over the gruesome market hunting of birds, and the deployment of mass-killing military weapons like the "punt gun" that were considered fundamentally unfair to animals.³¹⁷

314. See Michael Bean, *The Legal Framework for the Development of Federal Wildlife Law*, in *THE EVOLUTION OF NATIONAL WILDLIFE LAW* 7 (1997).

315. 16 U.S.C. §§ 703–711.

316. See DALE GOBLE & ERIC FREYFOGLE, *WILDLIFE LAW CASES AND MATERIALS* 459–60 (2010); *Convention Between the United States and Great Britain for the Protection of Migratory Birds*, U.S.–Gr. Brit., Aug. 16, 1916, 39 Stat. 1702.

317. *Id.*; see also Andrew G. Ogden, *Dying for a Solution: Incidental Taking Under the Migratory Bird Treaty Act*, 38 WM. & MARY ENVTL. L. & POL'Y REV. 1, 5–6 (2013).

Likewise, when Congress enacted the first federal legislation to protect endangered species in 1966,³¹⁸ the bill didn't make its way into law based on scientific arguments about the mechanics of biodiversity. Instead, environmental advocates, working in tandem with animal protection groups, used the majesty of the Whooping Crane as their poster-child to ignite public support for the legislation.³¹⁹ The revised and expanded Endangered Species Act of 1973 does not merely concern itself with the preservation of species as a whole, but instead makes it a federal crime to kill any single member of any species listed under the Act.³²⁰ Additional examples of environmental laws driven by the public's concern for individual animals abound.

The Marine Mammal Protection Act is widely taught in law schools as a conservation law devoid of any concerns beyond maintaining "optimum sustained populations" of marine populations.³²¹ But the MMPA's enactment was driven by a coalition of environmental and animal advocates who tapped public outrage over the brutal clubbing of baby seals that filled television sets across the country

318. Endangered Species Preservation Act 1966, Pub. L. No. 89-669, 80 Stat. 926.

319. See Charles C. Mann & Mark Plummer, *NOAH'S CHOICE: THE FUTURE OF ENDANGERED SPECIES* 145 (1995) ("the swell of excitement about the whooper . . . led in the 1960s to the first federal programs to protect endangered species, and in 1973 to the Endangered Species Act itself"); Robert Porter Allen, *Research Report No. 3 The Whooping Crane*, NAT'L AUDUBON SOC'Y 204 (1952) (We "have singled out the Whooping Crane for survival for reasons that are peculiarly our own, in the face of possibility that Nature had already greased the skids to its ultimate destruction.").

320. Endangered Species Act, Pub. L. No. 93-205, 87 Stat. 884 (1973) (codified at 16 U.S.C. §§ 1531-1544 (2000)); see 16 U.S.C. § 1538 (2012); see also 509 C.F.R. § 17.31. Had Congress desired to merely ensure the survival of populations without regard to the individual members of those populations, the entirety of section 9 of the Act's prohibition on "take" would be nearly superfluous, and section 7's prohibition on federal agency actions that "jeopardize" the continued existence of an entire species could have simply been extended to private actions as well. See 16 U.S.C. § 1536 (2012).

321. 16 U.S.C. §§ 1361-1423. The summary provided by the U.S. Marine Mammal Commission on its website provides a good example of just how narrow and crabbed the understanding of the MMPA and its purposes are presented in modern discourse. According to the Commission, the MMPA "was enacted in 1972 in partial response to growing concerns among scientists and the general public that certain species and populations of marine mammals were in danger of extinction" and that the Act "set forth a national policy to prevent marine mammal species and population stocks from diminishing, as a result of human activities, beyond the point at which they cease to be significant functioning elements of the ecosystems of which they are a part." *About the Commission*, U.S. MARINE MAMMAL COMMISSION, <https://www.mmc.gov/about-the-commission/our-mission/marine-mammal-protection-act/> (last visited Jan. 26, 2017). To say that this summary is incomplete doesn't do justice to just how much it ignores the MMPA's true purpose in favor of cold scientific language about "significant functioning elements of the ecosystem" and similar enviro-jargon.

in the early 1970s.³²² The true purpose of the law, and its intent to protect the individual animals, is amply demonstrated by its legislative history, which states:

Recent history indicates that man’s impact upon marine mammals has ranged from what might be termed malign neglect to virtual genocide. These animals, including whales, porpoises, seals, sea otters, polar bears, manatees and others, have only rarely benefitted [sic] from our interest; they have been shot, blown up, clubbed to death, run down by boats, poisoned, and exposed to a multitude of other indignities, all in the interests of profit or recreation.³²³

As the late Justice Skelly Wright noted in *Animal Welfare Institute v. Kreps*—one of the few reported cases ever touching on this issue—“[t]he legislative history confirms that Congress meant to refer to individual animals, not groups or populations” in several of its provisions, that “Congress was responding to an emotional conviction that killing babies who were still nursing was intolerably cruel,” as well as “public indignation” and “public opinion” about the “vulnerability and helplessness” of individual baby animals.³²⁴ This should not surprise anyone who worked to enact the legislation, as it represented the high-water mark of cooperation between national environmental and animal welfare organizations.

This same reliance on the public’s concern for individual animal suffering can be seen in the Oil Pollution Prevention Act of 1990³²⁵—enacted in the wake of the Exxon Valdez disaster, and fueled by images of helpless birds and marine mammals, covered in oil, struggling and dying on Alaskan beaches.³²⁶ During this same period, environmentalists were fighting perhaps their biggest conservation

322. See GOBLE & FREYFOGLE, *supra* note 316, at 834–35; see also H.R. REP. NO. 92–707, at 4148–49 (1971) (“There has been great public concern and indignation over the annual seal ‘hunt’ off the Canadian coast, where thousands of baby harp seals have been killed each Spring, at less than a week old. Witnesses urged the Committee to establish an absolute ban on the U.S. import of skins from these animals, and the bill provides such a ban.”).

323. H.R. REP. NO. 92–707, *supra* note 322, at 4144.

324. *Animal Welfare Institute v. Kreps*, 561 F.2d 1002, 1011–12 (D.C. Cir. 1977); see also *Georgia Aquarium, Inc. v. Pritzker*, 135 F. Supp. 3d 1280 (N.D. Ga. 2015).

325. 33 U.S.C. §§ 2701–2762 (1990).

326. See Jeffery D. Morgan, *The Oil Pollution Act of 1990*, 6 FORDHAM ENV. L. REV. 1, 4 (1994) (“As thick black sludge washed onto the formerly pristine coast, wildlife activists scurried around heaping piles of animal carcasses in an effort to rescue marine mammals and sea birds. Even those individuals who previously had not considered themselves part of the now well-organized American environmental movement, were outraged by the daily images. The nation gasped, and Congress responded in a rare act of unanimity”).

battle of the 20th Century, over logging of old growth forest in the Pacific Northwest.³²⁷ For the most part, that battle was not presented to the public based on the grandeur of old growth redwoods or arguments over their inherent value. Instead, like virtually every other major environmental battle, it was messaged around the plight of an iconic animal—the Spotted Owl.³²⁸

The point of these observations is not to criticize environmentalism for its longstanding use of animal welfare sentiment to advance its goals. Nor is it to discount the numerous successful public policy campaigns carried out in union with the animal protection movement. Rather, it is to highlight the untapped potential for collective action by environmental and animal protection advocates on climate change, and the 100-year track record of success to back it up.

However, any renewed alliance between these movements will have to overcome some lingering misconceptions about the incompatibility between environmentalism and animal protection. After decades of collective success, the alliance between environmentalism and animal protection suffered in the 1980s and early 1990s, split apart by academic scholarship in both camps suggesting that environmentalists are solely concerned with the preservation of “populations” and ecosystems while caring nothing for individual animals. Animal advocates, on the other hand, were characterized as being myopically focused on the “rights” of “the individual” animal, and having no regard for the preservation of ecosystems or the plight of endangered species.

Environmental ethicist J. Baird Callicott appears to have fired the first shot by publishing *Animal Liberation: A Triangular Affair*—an article about the inherent incompatibility between the environmentalism and animal protection that was so polarizing and hostile that Callicott himself later recanted and modified his position.³²⁹ Animal rights ethicist Tom Regan returned the favor in 1983 when his influential book *Animal Rights* labeled environmentalism’s valuation of the entire “biotic community,” and its acceptance of certain cases where “the individual

327. See, e.g., William Dietrich, *THE FINAL FOREST: THE BATTLE FOR THE LAST GREAT TREES OF THE PACIFIC NORTHWEST* (1993).

328. See Brian Mottaz, *Spotted Owl Caught in Middle of Battle for the Northwest’s Old Forests*, UNITED PRESS INTERNATIONAL (May 24, 1987) http://articles.latimes.com/1987-05-24/news/mn-2319_1_spotted-owl-habitat; Alyson Flournoy, *Beyond the Spotted Owl Problem: Learning from the Old-Growth Controversy*, 17 HARV. ENVTL. L. REV. 261 (1993).

329. See generally J. Baird Callicott, *Animal Liberation: A Triangular Affair*, 4 ENVTL. ETHICS 311 (1980).

may be sacrificed for the greater biotic good,” an ethic that “might be fairly dubbed ‘environmental fascism.’”³³⁰

An entire host of increasingly theoretical and reductionist articles were churned out during the 1980s and early 1990s—all seeking to find the crunchy center of the allegedly fundamental conflict between two ethical positions that had worked successfully in tandem for more than a century. The key collection of these works is the 1992 publication, *The Animal Rights/Environmental Ethics Debate*,³³¹ which is of historical interest, but painfully out of date and filled with content that not only demonstrates a lack of understanding of the real-world functioning of environmentalism and animal protection, but also seeks to foment the maximum level of conflict between environmentalism and animal protection.³³²

My concern about this scholarship is not that it fails to identify potential hypothetical cases where a strict Regan-based view of individual animal rights can conflict with certain biotic community-focused environmentalism. Indeed, there are certain cases where the interests of the larger ecosystem or an entire species come into conflict with the interests and/or rights of individual animals (or individual trees or plants for that matter). This is true with regard to matters of competing human rights and interests as well. The problem with the entire line of inquiry is that it concerns a hypothetical conflict between two extreme versions of animal and environmental ethics that have very few adherents in the real world.³³³

330. TOM REGAN, *THE CASE FOR ANIMAL RIGHTS* 362 (1983).

331. EUGENE HARGROVE, *THE ANIMAL RIGHTS/ENVIRONMENTAL ETHICS DEBATE* (1992).

332. A limited effort to put Humpty Dumpty back together again was later spearheaded by Callicott—perhaps as atonement for his role in fracturing a valuable alliance that had delivered a century of progress for animals and the environment. Callicott penned “*Animal Liberation and Environmental Ethics: Back Together Again*,” followed by Dale Jamieson’s “*Animal Liberation is an Environmental Ethic*,” which largely accepted Callicott’s revised and inclusive position, and provided important context for the relationship between animal protection and environmentalism. See J. Baird Callicott, *Animal Liberation and Environmental Ethics: Back Together Again*, 4 *BETWEEN SPECIES* 3 (1988); Dale Jamieson, *Animal Liberation is an Environmental Ethic*, 7 *ENVTL. VALUES* 41 (1998). However, Jamieson’s inclusive framework was promptly burnt to and by a Crisp, who shot back with a piece entitled “*Animal Liberation is Not an Environmental Ethic: A Response to Dale Jamieson*.” See Roger Crisp, *Animal Liberation is Not An Environmental Ethic: A Response to Dale Jamieson*, 7 *ENVTL. VALUES* 486 (1998). Thankfully, no scholar has yet retorted with a piece entitled “*Is Too*.”

333. There is another problem with this line of inquiry. To even speak of “environmentalism,” or “animal protection” is to refer to a large class of varying value judgments held by millions of people, loosely affiliated within a broad community concerned about the well-being of animals and the environment. Much like trying to categorically define what constitutes a “Democrat” or a

A full deconstruction of this ahistorical theory of an unresolvable “conflict” between animal welfare and environmentalism is both beyond the scope of this work and an impermissible indulgence given the crisis at hand.

The fact of the matter is that the existential threat of climate change renders any perceived conflicts among individual adherents to various animal and environmental positions a practical nullity. One need not identify and catalog all the potential philosophical differences between public health, poverty, civil rights, child advocacy, or other social movements to recognize that they share a common threat in climate change, and thus must work together to mitigate its impacts. Similarly, we need not resolve any actual or perceived differences between environmentalist and animal protection advocates to see the critical need to form an alliance against climate change. Rather, we need merely to acknowledge that both ethical positions are grounded in a deep respect for the intrinsic value of life—both flora and fauna—and are therefore the best jumping off point for a unified, multidisciplinary effort to tackle the common enemy of unmitigated anthropomorphic climate change. Once these two movements are properly aligned in collective action on climate change, the circle can be progressively widened to include a whole host of climate change stakeholders, many of whom are also not fully engaged concerning this existential threat to their constituents.

The argument for a renewed alliance between the environmental and animal protection movements on climate change is not only pragmatic, it is also scientific. It turns out that humans are hard-wired from a very early age to respond to non-human animals, with particular attention to baby animals. An influential study entitled, *Baby Schema in Human and Animal Faces Induces Cuteness Perception and Gaze Allocation in Humans*, correlated the broad collection of literature on human’s unique reaction to baby humans, and animals that resemble baby humans—the so-called baby schema effect.³³⁴ The

“Republican,” fixed definitions of the concepts of environmentalism and animal protection do not exist, and indeed may not be amenable to generic labels at all. Add to that the more easily defined but still opaque concept of “animal rights,” and one is left with a broad, bickering, and dis-unified mass of pro-animal ethical positions which are more often in conflict with each other than they are with environmentalism. The concept of “environmentalism” is somewhat more amenable to generic identification, but still represents millions of people with differing ethical views, all orbiting around the core concept of conservation. Any effort to hammer this multitude of round pegs into the square holes of “environmentalism” or “animal protection” is an inherently flawed task, and one that is not necessary for purposes of this discussion.

334. Marta Borgi et al., *Baby Schema in Human and Animal Faces Induces Cuteness Perception and Gaze Allocation in Humans*, 5 FRONTIERS PSYCHOL. 1 (2014).

phenomenon, first described in relation to human's inherent attraction to, and protective feelings for, infants, has since been confirmed through a multitude of studies to apply cross-species—most notably between humans and baby mammals.³³⁵ As the authors note,

It has been hypothesized that humans exhibit a natural interest and attraction to other species (the so-called Biophilia Hypothesis, Wilson, 1984). A general proneness towards animals is observed in children from a very early stage of development. Children are more likely to be attentive to and have increased motivational levels in the presence of animals Even in subjects with a deficit in the social domain (i.e., autism spectrum disorder) a preference for animal over human and inanimate stimula has been shown.³³⁶

The study concluded that “human positive appraisal towards animals that appear only partially dependent on the presence of infantile features,” and the positive appraisal exists even when the human observer is “not directly linked with familiarity with them (e.g., pet ownership).”³³⁷

A follow up study in 2016 assimilated additional research showing that “[a]nimal physical appearance, including aesthetic qualities was shown to be a salient factor underlying human attitudes towards animals,” and that “[a]nthropomorphic features, large size and neotenus (juvenile) traits, represents the animal attributes that have been most consistently shown to affect human preferences and attitudes” towards animals.³³⁸ These theories have already been incorporated into product design,³³⁹ planning, and architecture³⁴⁰ and are a powerful potential force for public policy concerning animals and climate change—perhaps even more powerful than the plight of the world's poor and other vulnerable human populations standing in the destructive path of climate change's merciless wrath. If human's biological and psychological impulses to protect animals are sufficiently ingrained to be incorporated into product

335. *Id.*

336. *Id.* at 1; see also STEPHEN KELLERT & EDWARD WILSON, *THE BIOPHILIA HYPOTHESIS* (1993).

337. Borgi et al., *supra* note 334, at 10.

338. Marta Borgi & Francesca Cirulli, *Pet Face: Mechanisms Underlying Human–Animal Relationships*, 7 *FRONTIERS PSYCHOL.* 1, 2 (2016).

339. Linda Miesler et al., *Isn't it Cute: An Evolutionary Perspective of Baby–Schema Effects in Visual Product Designs*, 5 *INT'L J. DESIGN*, 17, 17–18 (2011).

340. S. Kellert, *BIOPHILIC DESIGN: THE THEORY, SCIENCE, AND PRACTICE OF BRINGING BUILDINGS TO LIFE* (2008).

advertising, this is a strong signal that they are also a powerful tool for climate advocacy, and thus should be deployed by the animal protection movement immediately.

Activating the animal protection community on the issue of climate change, and taking advantage of the historically proven power of collective action by environmental and animal protection advocates are just two examples of how climate change campaigners can increase their effectiveness by tapping into powerful public interest stakeholders lingering on the edges of the current climate change battle. Similar inflection points need to be located and activated throughout the public interest community.

In comparison to the situation with animal protection, there has been more progress engaging public health, civil rights, and other affected constituencies on the issue of climate change—but only to a point. To date, many of these interests have been relegated to what can fairly be called the “also affected” afterthoughts in climate change advocacy. This can be seen in the stacks of glossy reports on climate change that contain pages and pages of the standard environmental messages about melting ice, sea level rise, and mean temperature spikes, followed by comments about how these things “also affect” public health, or the economically disadvantaged, or people of color. In order to move the issue of climate change front and center, the order of clauses in this narrative needs to be reversed.

The environmental community has done Herculean work over the last three decades fighting climate change on its own, and has every justification for feeling both ownership of the issue, and perhaps even some level of resentment towards other movements that have lingered for far too long at the edges of this crisis. But in order to transform this issue into a first-tier public policy matter—one that might merit even a single question from a moderator at a presidential debate—environmentalists will have to take a step back and make room for additional stakeholders to join the circle. This may necessarily involve giving up some level of control, and perhaps even identity in the process. The major public interest movements discussed above need to step up and become fully active on the issue of climate change—they cannot remain the “also affected” any longer. As environmental luminary and life-long animal welfare advocate Rachel Carson once warned:

We stand now where two roads diverge. But unlike the roads in Robert Frost’s familiar poem, they are not equally fair. The road we have long been traveling is deceptively easy, a smooth superhighway on which we progress with great speed, but at its end lies disaster. The other fork of the road—the one less

traveled by—offers our last, our only chance to reach a destination that assures the preservation of the earth.³⁴¹

If we are to ask a broad coalition of public interest causes to look beyond their own identity politics and travel collectively down the difficult road against climate change, we must first come to terms with our own parochial movement-specific interests, and then not only make room in the circle for other climate change stakeholders, but do everything in our power to push them to the forefront of the fight.

CONCLUSION

The corpus of this paper has been largely descriptive rather than proscriptive. This is intentional. The threat to most major social movements posed by climate change is so poorly understood that it is important to catalog and digest these threats before moving into potential solutions. The magnitude of the impacts of climate change discussed above—much of which is already well underway—is difficult to internalize, or—for many Americans—to even believe at all. The indiscriminate and generalized threat of climate change is both a strength and weakness for those working to mitigate its effects.

The danger of defeatism looms at every turn in this sector, as the constant deluge of extraordinary flooding, heat, and other extreme climate events continue to permeate the mainstream media. The problem of climate-change denial among elected representatives is so pervasive that it is not defeatist, but rather common sense, to conclude that the solutions to this problem are not going to be forthcoming from either Congress or the Executive branch. Those who believe that sooner or later Congress “must” act on climate change are likely to be disappointed, and not unlike the people of New Orleans, watching the water rise and waiting for a rescue that never arrives. To overcome these institutional failures, entirely new alliances, strategies and tactics will need to be conceived and deployed collectively if they are to have any meaningful impact on the climate change crisis already underway.

The next paper in this series will discuss the problem of priorities and tactics for a new climate coalition. No amount of collective action among different interest groups can be effective unless there is at least some basic level of

341. Rachel Carson, *SILENT SPRING* 277 (1962).

agreement about the priority of controlling different GHG sources and a unified plan for where to focus our collective efforts. The ultimate question is whether climate advocates can more effectively harness the power of consumer choice and investor preference to control corporate emissions in ways that traditional laws and regulations simply cannot. Over the last decade, the animal protection movement has by necessity deployed a corporate, consumer, and courtroom legal and policy strategy that could be a model for the next generation of climate change advocacy. Given the state of national political and regulatory gridlock, and the inherently limited capacity of the CAA and other existing command and control structures to meaningfully address GHG emissions, the adoption of an alternative strategy might be the only remaining hope to mitigate some of the dangers of climate change. After decades of neglect, only a collective and creative new effort can possibly confront the cataclysmic problem we now face. The crisis of climate change has moved beyond environmentalism, and we must look to non-traditional alliances and strategies for our solutions.