

Dædalus

Journal of the American Academy of Arts & Sciences

Fall 2020

Witnessing Climate Change

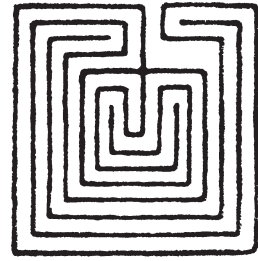
Nancy L. Rosenblum,
guest editor



with Robert Jay Lifton · Naomi Oreskes
Robert H. Socolow · Dennis F. Thompson
Michael B. Gerrard · Mark A. Mitchell
Patrick L. Kinney · Rebecca Henderson
David W. Titley · Elke U. Weber · Jessica F. Green
Rafe Pomerance · Carolyn Kormann
Scott Gabriel Knowles · Antonio Oposa Jr.



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“Witnessing Climate Change”

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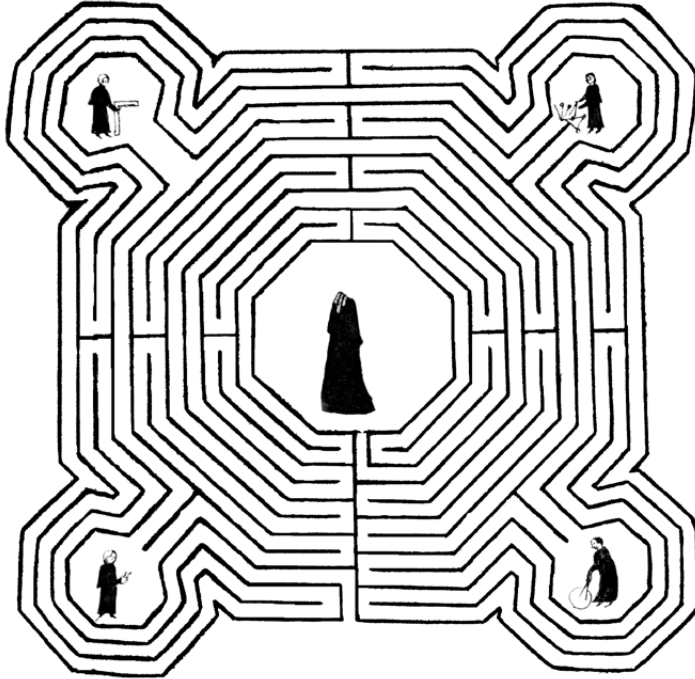
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The pavement labyrinth once in the nave of Reims Cathedral (1240), in a drawing, with figures of the architects, by Jacques Cellier (c. 1550–1620)

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Introduction: Paths to Witnessing, Ethics of Speaking Out

Nancy L. Rosenblum

Writing about the threat of nuclear catastrophe in *The Fate of the Earth*, Jonathan Schell observed: “the act of thinking about it is always voluntary, and the choice of not thinking about it is always available.”¹ The same can be said for most of us, most of the time, when it comes to the unthinkable of unchecked climate change. But the choice is not available to men and women whose work is to comprehend the radical dangers of climate change, and to act on what they know. For the authors in this issue of *Dædalus* – along with many other scientists, doctors, public health experts, social scientists, lawyers, journalists, business consultants, and military officers – climate change shapes their professional identity and expands their sense of responsibility. They find thinking about its many elements within strict disciplinary confines constraining, and the codes of professional ethics that govern day-to-day practice inadequate. The extraordinary challenges they confront require more. They push the bounds of their fields and they push themselves to become *witnessing professionals*.

The term witnessing professionals is not part of common parlance. Yet we need a name for those who speak out from the vantage point of their specialized knowledge about the dangers posed by crises like climate change. In this volume, the authors reflect on their paths into climate work and bearing witness to what they know. Each focuses on a different aspect of climate change’s effects and responds to it, so that this constellation of essays helps us grasp that climate change is not one single fearful thing. The familiar phrase obscures its many-sidedness. We may, as Carolyn Kormann writes in her contribution to this collection, “try to see the whole of the moon,” but we must also appreciate the innumerable, dynamic facets of climate change.² Its devastation is pluralistic. It ravages the earth as we know it: Arctic ice, rain forests, islands, and reefs; health and habitats; economic systems and social arrangements; and for many people worldwide, it deranges everyday life. Climate change is all encompassing, and so is the domain of witnessing professionals.

As I write (July 2020), professionals are speaking out about another global threat: a pandemic of SARS-CoV-2, a highly communicable virus causing disease, death, and massive social and economic dislocation. Epidemiologists and public health authorities track the path of the COVID-19 contagion and recommend policies and practices in an attempt to contain its spread. They document the nation's ongoing unpreparedness: inadequate supplies of tests for the virus and store of protective equipment, ventilators, and ICUs. They issue grim warnings about misinformation coming from government officials in the United States, beginning with the president, and they report the erratic, disorganized actions taken by inexperienced political appointees who head the very federal agencies charged with managing national emergencies. A trauma doctor spoke out in *The New York Times*: "The sky is falling. I'm not afraid to say it."³ They become witnesses.

The authors of "Witnessing Climate Change" address a global phenomenon that is slower moving than viral contamination and has no foreseeable end. We gather reflections from men and women immersed in the greatest problem of our time, perhaps of all time: the changing composition of the atmosphere that is altering the earth on a planetary scale. There is no historical model. We see the authors figuring out as they go along the meaning and value of their work, struggling with the necessity and the limits of the authority of expertise, building institutions to draw others into their fields, and finding ways to educate, advise, organize, advocate, and warn policy-makers and the public. Here are odysseys of careers and activism growing from specialized knowledge, by men and women contemplating what it means to respond ethically to this all-encompassing crisis. They speak mainly of experiences in the United States, but their reflections have universal application.

The authors range in age from their thirties to nineties, and they took up climate work and began to speak out at different points in their careers and at different points in their professions' commitment to understanding and action. Multi-generational witnessing adds a special dimension of interest: these accounts add up to a chronology of the evolution of knowledge about climate change from a small circle of scientists into myriad professional spheres and public arenas.

Several themes unite these personal narratives: the path into climate-related work, the constraints imposed by standard codes of professional ethics and the imperative to move beyond them, and the settings and institutions they build to do what Elke Weber calls the "missionary work" of advancing our understanding and communicating widely what they know. They share the moral imperative to speak out, and they recount the challenges and especially the ethics of witnessing.

Climate change's gathering effects occur slowly and vary from place to place; in contrast to intense public preoccupation with the frightening invisibility, disease, and death of the COVID-19 pandemic, attention to climate is fragmented and sporadic. Witnessing professionals to climate change have to arouse and then re-

arouse public awareness. They have to continuously decry inertia and shortsightedness. They struggle against the malignant duo of political opposition and political paralysis.

Sustaining hope in the face of accelerating destruction is the emotional burden witnessing professionals assume. Despite advances in knowledge and organized political activism, mitigation is anemic. Targets are missed, greenhouse gas emissions are rising, and 2019 was the second-warmest year on record, in the warmest decade on record.⁴ In 2020, there were wildfires in the Arctic. Research is underfunded. International cooperation is brittle and intermittent. Entrenched obstacles, including impenetrable layers of legal and political jurisdiction, stymie local efforts at adaptation to protect against foreseeable climate-related disasters. Yet hope is elemental to witnessing. Despair is not just psychologically harmful but would be a “mistake.”⁵ And by continuing to expose and act upon painful truths witnesses can communicate a sense of hope.

In April 2018, *The New York Times* published a story, “Climate Change Denialists Say Polar Bears Are Fine. Scientists Are Pushing Back.” Turning “the charismatic bears to their own uses,” deniers challenged scientific evidence of the physical decline of the polar bear population linked to the loss of Arctic sea ice. Rejection of the science of climate change and its effects was nothing new; what made headlines was that fourteen researchers resolved to expose this disinformation campaign. The deniers renewed their attempts to discredit them, calling the scientists’ response a hit piece by “climate bullies,” “smack talk,” and, ramping up their assault, an act of “academic rape.” They demanded a retraction. They filed Freedom of Information Act requests for three of the scientists’ correspondence and agitated for another, Jeffrey Harvey, to be reprimanded for “conduct unworthy of serious scientists.”

The decision to speak out, Harvey explained, was precipitated by the

increasing frustration scientists felt about the spread of false information, the disregard of established evidence, and the harassment of researchers. . . . Every time these deniers make some outlandish claim on the media and we don’t respond to it, it’s like a soccer match and we’ve given them an open goal.⁶

In publicly defending their calculations of the status of Arctic ice and polar bear populations, the scientists were making a larger point. Polar bears need sea ice; it’s a question of habitat loss, “there’s nothing more complicated than that.”⁷ They connected their research to the endangered habitats of virtually all life forms, including our own.

These scientists defended the integrity and validity of their research and insisted on its significance. They pushed back against those who challenged not only their legitimate claim to specialized knowledge, but also its meaning and value for

decision-makers and the public. As Jessica Green puts it, “If we don’t clearly voice our views . . . to counteract misinformation . . . our knowledge will be irrelevant.”⁸

Witnessing professionals are drawn into battle against climate rejecters and deniers and, at the same time, against the wider, wholesale delegitimation of knowledge-producing institutions and expertise. Assaults on the value and authority of specialized knowledge have become a familiar, degrading part of public life, and delegitimation of climate work is particularly ferocious in the United States and at the highest levels of government.

It has multiple sources: fossil fuel industry disinformation campaigns to obstruct regulation of emissions, entrenched economic interests such as real estate developers hungry to build, and bad-faith accusations of partisan bias. Delegitimation also takes the form of wild conspiracy claims: the head of the Environmental Protection Agency (EPA) casts public health researchers as a cabal producing “secret science,” and advocates for regulation of greenhouse gas emissions are accused of plotting to impose despotic measures that extinguish personal freedom.⁹ As one advisor to President Trump charged, “They want to take your pickup truck, they want to rebuild your home, they want to take away your hamburgers. This is what Stalin dreamed about but never achieved.”¹⁰

Speaking out as scientists of the Arctic did is the oppositional face of witnessing. There is also a constructive side: witnessing as education, advocacy, and institution-building. From their professional vantage points, the authors call attention to aspects of climate change that are less prominent than, say, sea level rise. They do not confine themselves to expert circles. They lecture, publish, post on the Internet, and talk to the media. They join and counsel NGOs and international bodies. They bring lawsuits and file amicus briefs. They build and participate in advocacy groups and transnational organizations. They form alliances across fields and across national boundaries. Witnessing professionals sit on commissions and scientific advisory boards and testify before congressional committees. They provide vital information to government agencies; Patrick Kinney describes his satisfaction when the EPA used his findings on fine particle pollution to successfully argue that carbon dioxide and other greenhouse pollutants had adverse health effects and were therefore within the agency’s authority to regulate.

Writing in 2019 from the Korean peninsula during a record heat wave and amidst threats of nuclear missile attack, Scott Knowles observes: “The reality is that the slow disaster of climate change . . . is every bit as ominous as the threat of war, it’s just unfolding at a pace that makes it harder for us to keep in the front of our minds.”¹¹ Yet witnessing professionals do just that.

Witnessing climate change adds a dimension to our moral lexicon. The classic moral witness is a survivor of atrocity so horrifying that it evokes evil. Genocide is the grim touchstone. Survivors look back-

ward. They tell what they endured and speak for those who died. They name and blame the people at whose hands they suffered dehumanization, and demand that the perpetrators be identified and punished. They hope to make their unspeakable experience meaningful. By testifying to the identity of perpetrators and the character of events, they can enhance collective memory.¹²

Sometimes professionals are witnesses of this kind even though they do not personally suffer the ghastly violations they report. Anthropologists studying bones to identify victims of mass killing and journalists and photojournalists documenting organized ethnic rape and murder know that the facts they present provide proof of what has happened here. Their work has moral and historical importance. People must be made aware and condemn the evil that made it necessary to identify bones and report atrocity.

But when it comes to the effects of climate change, we are all victims, and certainly in advanced industrial countries, we are all perpetrators. The harm is ongoing, not safely relegated to the past. Witnesses to physical devastation and masses of climate refugees, the extinction of ecosystems and the species that inhabit them, tell stories of suffering and the human cause of suffering. They are not, or not always, acts of willful cruelty, yet the ultimate impact is wanton destruction.

Until thirty years ago, only a small company of scientists recognized climate change and its causes. The turning point was the 1988 congressional testimony by James Hansen, director of NASA's Goddard Institute for Space Studies. He delivered the critical warning: global warming is not a natural variation in climate but can be ascribed with a high degree of confidence to the buildup of carbon dioxide and other gases in the atmosphere. From then on, climate change could not be seen as the unintended consequence of measures to improve human well-being by means of energy produced from fossil fuels. For decades, we have known that none of the basic activities of ordinary life that rely on energy from carbon-based sources are harmless. Robert Jay Lifton calls the condition under which we continue to worsen climate change just by doing what we ordinarily do "malignant normality." "We are born into it," he writes, "and nothing in our lives is outside of it."¹³

Climate change and extreme weather events – wildfires, floods, heat, and drought – require us to exercise the extraordinary human capacity for adaptation, which takes its place alongside mitigation of greenhouse gas emissions as a practical and moral imperative. Adaptation demands more than triage and rebuilding ruined homes after an earthquake. It calls for massive rearrangements: alterations in agriculture, for example, and relocation of entire communities vulnerable to sea level rise, and measures to deal humanely with the displacement of many millions of refugees from parts of the earth made uninhabitable by heat. Michael Gerrard outlines the legal tools available for local adaptation: flood maps, zoning codes, building codes, infrastructure specifications, insurance requirements, and

more. Yet speaking out about the need for adaptation is an underappreciated aspect of witnessing; Gerrard observes that legal practice in this area is “less glamorous than suing oil companies, and it tends to promise no more than local benefits, but it will be an important part of coping with the hot world to come.”¹⁴ Adaptation also presents a confounding dilemma, and in our conversation for *Dædalus*, Rafe Pomerance delivers a cold truth: “What are you adapting to? What climate system are you adapting to? One or two degrees warmer or five degrees warmer? The climate is now transient. . . . There is no equilibrium state anymore.”¹⁵

“**A**cademic writing typically does not happen in the first person singular,” Elke Weber notes. These essays are an exception: the authors reflect on their paths to witnessing. Becoming a witnessing professional entails two deeply transformative processes. The first is a commitment to a professional identity, and as these essays show, it takes a second transformation to propel professionals into the public square.¹⁶ Witnessing is not how the authors understood their role at the start of their careers. They began doing work they were trained to do, in familiar settings, and in accord with “bread and butter” professional ethics, which, they learned from experience, are an inadequate guide for confronting the practical and moral challenges their work exposes. Their idea of social responsibility expands.

This sense of purpose occurs against the background of powerful, often conservative forces of professional education and of professional associations that define and police practice. They set requirements for training and qualifications for certification, advancement, and tenure. They deliver the privileges that come with professional positions and status. They judge and discipline. Professional associations work to preserve their authority over members and their autonomy vis-à-vis government.

George Bernard Shaw once declared these institutions “conspiracies against the laity.”¹⁷ That is an overstatement. But broadly speaking, professionals enjoy independence and discretion; many work in settings that do not subject them to direct supervision and accountability. They can do great harm. Dennis Thompson had a leading role in establishing ethics requirements in professional schools around the world, and notes that it took a wave of scandals to prompt programs to begin to teach “role morality.” “Applied ethics journals sprang up,” Thompson recalls. “The ethics movement gained momentum not only among lawyers and doctors but also in the training of police officers, veterinarians, accountants, even economists.”¹⁸

Sociologist Émile Durkheim’s concept of “moral particularism” captures the nature of codified professional ethics. “It has been observed since Aristotle,” he wrote, “that . . . morals vary according to the agents who practice them” and

“a system of morals is always the affair of a group and can operate only if this group protects them by its authority.”¹⁹

Codes of professional ethics typically contain a mission statement idealizing selfless service and benefits to others.²⁰ Their chief purpose, however, is to set the parameters of standard practice: the terms governing research on human subjects, for example, responsibilities toward patients and clients, requirements of data access and transparency, and avoiding conflicts of interest. They constrain what practitioners should and should not do with their specialized knowledge, and the step into witnessing stands out against the background of these constraints. The American Political Science Association, for example, of which I am a member, allows that academics in the field have the rights and obligations of any citizen, but says nothing about obligations to public life arising from their work. Indeed, some professional norms mandate silence with regard to the affairs of clients or to protect proprietary information about climate change’s impact on business. They also censor experts in order to avoid political conflict. For this reason, David Titley shows, the military controls publicizing its strategic focus on climate effects on military bases, supply chains, and regional conflicts inflamed by drought and food scarcity.

Moreover, because professional schools and associations shape education, offer funding, and sponsor prestigious publications, they define and entrench what questions are important to address and methods for addressing them. At business schools, Rebecca Henderson explains, climate change was considered an “externality” costly to society but not to the firm, and until very recently, it was not part of any curriculum. Jessica Green observes that when it comes to conferences, peer-reviewed publications, and hiring and promotion decisions in political science, narrow disciplinary criteria apply and both climate research and activism are devalued: “I had politics trained out of me.”²¹

Of course, professional associations can facilitate speaking out. Mark Mitchell discusses the National Medical Association (NMA), founded in 1895 to represent African American physicians, who were excluded from the American Medical Association. The NMA focuses on communities “ignored by the larger climate organizations and health organizations whose members did not face the same threats.”²² It gave its members a collective voice and credibility to their warnings about the effects of toxic environmental exposures in their patients.

Writing about the natural and political disaster of Hurricane Katrina, Mitchell observes that effective disaster policy requires an understanding of local communities: “The ‘experts’ don’t know that many people will not get on an evacuation bus without their pets and without knowing where it is going.”²³ Rebecca Henderson and Carolyn Kormann describe their experiences with professional schools that hire faculty and design curriculum to enlarge the terrain of what counts as relevant knowledge.

Professional associations and education are the background from which witnessing professionals emerge, and standard professional ethics rarely entail an obligation to bear witness. Mental health practitioners' "duty to warn," for example, is a specific requirement to report dangerous patients to potential victims or the police. Witnessing professionals transform the "duty to warn" into an obligation to the wider society.

"Is it enough to do good science and publish it in reputable peer-reviewed journals?" Naomi Oreskes asks.²⁴ The authors question the adequacy of ethics designed for standard practice when we require what essayist Elaine Scarry called "thinking in an emergency."²⁵ The authors' paths to witnessing confirm the title of Patrick Kinney's essay: "Leaving the Comfort Zone."

These essays give paths into witnessing a face and a story. For some, an early experience propelled them years later into climate work and speaking out; we can think of their commitment as a calling. David Titley opens his essay with a memory from when he was six years old: "All I ever wanted to do was to forecast the weather."²⁶ The pain of being a target of racial slurs in school, Mark Mitchell recounts, led to his career combating environmental injustice in minority communities long before the concept of environmental justice was recognized by public health officials. Michael Gerrard traces the roots of his dedication to environmental law to his youth in Charleston, West Virginia, a polluted coal-mining area and hub of the petrochemical industry. He entered the arena when laws specific to climate change were undeveloped and "there was little law to practice." Carolyn Kormann was in third grade when she read about Biosphere 2 in a weekly children's magazine. "The idea of a monumental, glass, sun-drenched structure, in a faraway desert landscape, containing miniature versions of seven biomes – rain forest, ocean with a coral reef, desert, savannah, mangroves, intensive agriculture, and human habitat – was thrilling."²⁷

For others, serendipity propelled them down the path to speaking out. Antonio Oposa describes his youth on a small remote island in Central Philippines. When the most powerful typhoon to make landfall struck his region, he was driven to use the law – indeed to make new law – to protect the people of drowning island nations.

Rafe Pomerance's career was propelled by sheer chance. He describes "running across" an EPA report on the environmental impact of coal and saying to himself: "This can't happen!"²⁸ In 1972, as the facts and causes of climate change were just beginning to circulate within a small group of scientists, he took on the self-appointed mission to expand the circle and move climate change into the political arena. Later, he seized an opportunity to set an agenda for climate action. At the 1988 Toronto conference "Our Changing Atmosphere," he recalls, "I decided somebody had to start talking about making carbon dioxide reductions. I actually

made that decision. Nobody was talking about it, somebody had to talk about it, so I decided I'll talk about it."²⁹

Elke Weber's early work as a psychologist focused on financial risk when, in her first faculty position, she was thrown together with agricultural economists studying farmers' awareness of climate change. She recognized the unanticipated opportunity to address "the intellectual puzzle of our time: what lies at the root of pervasive inaction, wishful thinking, and denial."³⁰ Before the public health community began to think about climate change, an unexpected invitation to join a newly created team assessing climate's impact on the New York City region launched Patrick Kinney into his study of heat effects on health.

Robert Jay Lifton, at the age of ninety-one, coined the phrase "witnessing professionals" in his book *The Climate Swerve: Reflections on Mind, Hope, and Survival*, published in 2017. His plunge into the subject followed more than sixty years studying extreme situations in the twentieth and twenty-first centuries and leadership in the doctor's movement in opposition to nuclear arms. He calls nuclear and climate threats "the apocalyptic twins."

Witnessing is associated with testifying, advocating, and warning, but the authors remind us that expanding knowledge and the authority to speak out require institutions dedicated to these purposes, institutions that provide "research ecosystems" of colleagues, reliable funding, and career ladders to sustain the next generation of climate-oriented lawyers, scientists, and others, and to encourage public engagement. The authors are institution builders, and a sample of their initiatives provides another window into the many-sidedness of climate change itself.

Michael Gerrard founded the Sabin Center for Climate Change Law. Rebecca Henderson taught the first required course at Harvard Business School on the bearing of climate on business decisions. Elke Weber led the creation of the Center for Decision Sciences to advance social science collaborations among behavioral economists, psychologists, and anthropologists. David Titley led the first U.S. Navy Task Force on Climate Change, which acted as a "forcing function" to include climate impacts in strategic reviews for the Pentagon and the General Accountability Office. Patrick Kinney was among the founders of the first academic program dedicated to climate change and health. Mark Mitchell built the Connecticut Coalition for Environmental Justice and is associated with the recently created Medical Society Consortium on Climate and Health.

Novel legal strategies belong to this category of institutional innovation. "Lawyers are scrambling for legal theories that might be available," Michael Gerrard writes; avenues to creating a legal status for climate refugees, for example.³¹ Antonio Oposa, a legal advocate for the principle of intergenerational responsibility, describes his decision to bring the first (and successful) class-action suit with children as plaintiffs to oppose government deforestation.

As witnessing professionals move outside the company of colleagues, clients, and patients, they face a distinct set of practical and ethical challenges. How do they assess opportunities and select arenas for speaking out? Judge which powerful interests are susceptible to education and pressure? Expand the short time-horizons of policy-makers and the public? Facilitate involvement of people on the sidelines? Consider what activities are effective, where, and whether we even have a measure of efficacy?

Witnessing calls up qualities that are not part of any professional training, among them a fighting spirit and political judgment in the widest sense. It is infused with moral fervor, but urgency demands sensitivity to temper and tone. Rebecca Henderson describes coming to the insight that “there are some things one can say in public as an economist and as a businessperson, and . . . ‘the planet is burning and we must fix it at any cost’ is not one of them.”³² These essays make the challenges vivid.

The process of “translation” is the most familiar challenge experts face on entering the public square. Citizens carrying posters of polar bears and marching with 350.org, a leading activist group, are free to be personally expressive; they can speak the language of civic responsibility or religious conscience, green virtues or sanity. Professionals have the responsibilities of citizens but also the distinct obligations that come with expert knowledge, influence, and privilege. They struggle to communicate technical knowledge so that it is intelligible, its significance clear, and its tone modulated for specific groups of policy-makers and segments of the public.

For the same information can have opposite import depending on the audience. Robert Socolow observes that scientists outside of climate work are skeptical that 97 percent of climate scientists believe in human-induced warming; it goes against engrained assumptions that no finding is “incontrovertible,” and that confirmation bias is always a problem. At the same time, lay audiences are vulnerable to those who sow doubt about climate science by falsely claiming that experts disagree about whether carbon emissions are a principal cause of climate change; for the general public the accurate fact of 97 percent consensus is an effective corrective.

Because climate work does not respect disciplinary bounds, “learning how to talk,” as Patrick Kinney puts it, is also a requisite for working with colleagues across disciplines.³³ From “learning to talk” comes the creation of new fields, and Elke Weber describes the birth of “environmental decision-making.”³⁴

The challenge of translation is really the challenge of translations in the plural. Witnessing professionals must be multilingual.

Antonio Oposa poses the difficulty of getting a hearing differently. His approach to litigation to force government protection of old-growth forests is a form of storytelling. He explains: “If I went to the media and attended hearings in Con-

gress, who would listen to a young lawyer who represented trees? . . . But in a court of law, the story can be told better.”³⁵ Carolyn Kormann expands the principle of storytelling to journalism: “Reporting on climate change should require not just understanding and conveying the science, but understanding the culture of a place, the stories that a culture tells itself about itself. . . . These stories would always be tied to a landscape, and a place, they would always, in a sense, be local.”³⁶

There is no single rule for translating specialized knowledge; explanation must fit the audience and the purpose. Nor is there one best way of warning and propelling action. In *The Uninhabitable Earth*, journalist David Wallace-Wells insists that no approach is too dangerous to try. As he reads it, the 2018 report from the Intergovernmental Panel on Climate Change offered “a new form of permission, of sanction, to the world’s scientists” emboldening them to “scream as they wish to.”³⁷ Should they?

The authors reflect on the ethical challenges of speaking out. Many of these considerations are intrinsic to expert witnessing and center on the imperative to protect the authority of specialized knowledge. Canvassing the potential risks of witnessing, Dennis Thompson emphasizes the “obligation to respect the knowledge that is the basis of their authority to witness.”³⁸ Every contributor to this volume is sensitive to the demands of truth and honesty. They acknowledge the pitfalls of over- and oversimplification. They are aware of the risk that some forms of activism may undermine their standing as experts by raising questions about their objectivity. For many, that is the very definition of irresponsible advocacy.

Professionals can endanger their authority by overreaching or “fearmongering.” Robert Socolow advises climate scientists to build “a political middle” that diminishes polarization between apocalyptic assertions on one hand and lack of urgency on the other. Advocating for research funding to better understand the sensitivity of the earth to human activity and to assess the risks of worst outcomes associated with new technologies fall into this middle ground. But professionals can also fail as witnesses by excessive caution and reticence. Jessica Green warns against the propensity to avoid activism and to validate only modest incremental policies: “We are in a fight for our collective survival. This takes precedence over our precious credibility. . . . We need to plant a flag: we must be explicit about what our findings indicate we should *do*.”³⁹

“What we should do” is itself double-edged. On one side, witnessing professionals have been accused of abandoning objectivity just by advocating for specific policy solutions. They are liable to be cast as biased, as partisans. The authors do not accept this argument for constraint, and their witnessing often takes the form of pressing for and against specific actions. It is a different matter, however, if they prescribe policies that fall outside their own area of expertise. Naomi Ore-

skes insists that beyond the bounds of their own work, reticence is appropriate, not least because professionals model respect for specialized knowledge by deferring to colleagues in other fields.

Yet ethical considerations extend beyond the responsibility to protect the value and authority of specialized knowledge. A second set of moral considerations is not unique to professionals and the authors take on these daunting challenges as well.

They join moral philosophers in attention to injustice. Responding to climate change requires dismantling the structures of energy use that poison the earth and inventing both clean energy resources and new social and institutional resources. In all this, there is the imperative to assess kinds and degrees of suffering and inequalities in burdens and resources. Rafe Pomerance, Jessica Green, Michael Gerard, Mark Mitchell, and Antonio Oposa speak to the profound and vexing question of distributive justice within and among nations and across generations.

Witnessing professionals grapple with another aspect of justice. When public officials and others in a position to effectively address climate change and reduce its danger and suffering fail to take responsibility, they are active agents of injustice, and calling them to task is part of witnessing. Citizens who sit on the sidelines, perpetuating “malignant normality” and its differential effects, can be seen as passively unjust. The challenge for witnessing professionals is to appreciate both faces of injustice. At the same time, they must take care that demonization and castigation do not eclipse the constructive content of education, advice, and warning.

The perennial ethical question of means and ends presents its own set of challenges. What means are justified in pursuit of climate awareness and action? What forms of persuasion or manipulation should be ruled out? Elke Weber is a leading contributor to research on the cognitive mechanisms that obstruct thinking about the long term and make, in her words, “believing is seeing” as true as “seeing is believing.” She presses us to question how professionals should employ psychological knowledge in advising, warning, and prescribing action.

Political theorists (and politicians!) know that fear can be salutary. Considering whether professionals should induce or exploit fear, Weber argues that arousing dread is only temporarily effective; after all, people are loathe to suffer that emotional state for long. In order to motivate attention to climate change over time, fear must be paired with positive messaging.

There are many such challenges. “Framing” refers to how an issue is defined; in some settings, for instance, the terms “climate change” and “green” are interpreted as partisan and policy advocates substitute “energy-saving” or “good for health.” What is gained or lost by this shift in language? “Soft paternalism,” “nudging,” or “choice architecture” alters how information and incentives are presented in order to subtly redirect people’s actions; when is it warranted? Un-

certainty is endemic to many areas of climate research; how much transparency is necessary to avoid being misleading? Should the uncertainty of projections into the future be communicated to policy-makers? To lay audiences? Returning to an earlier example, acknowledging unknowns about the time frame of disappearing Arctic ice can be exploited to perpetuate popular doubt about the devastating demographic trends of polar bears.

The authors take on these ethical challenges. For many professionals, however, they are daunting and dampen willingness to step into the public arena. Naomi Oreskes observes that scientists in particular are reluctant to speak out, and she offers an additional explanation for their reticence. Scientists' sense of social responsibility is more limited today than in the past because of specialization, she observes. It orients them almost exclusively to their discipline and its community norms so that the prospect of collegial censure discourages witnessing. Against this insularity, Oreskes posits "the obligation to be witnesses, testifying to matters that they as the relevant experts are uniquely positioned to observe, understand, and explain to the rest of us."⁴⁰ She calls this robust demand "sentinel obligation."

Witnesses for climate change also confront fundamental political challenges. One is the uneasy relation between democracy and expertise. "Science isn't about . . . voting," Robert Socolow observes.⁴¹ True, but political decision-making is. Witnessing is imperative precisely because professionals share civic responsibility for responding to the climate crisis with other citizens.

Reconciling the authority of specialized knowledge with respect for democratic political agency is a perennial problem. Citizens and their political representatives have to judge when deference to the authority of expertise is warranted. Experts can be wrong. Experience provides good reasons to be wary of technological hubris and averse to paternalism. There are grounds for reasonable skepticism. Beyond that, unreasonable rejection of expertise, which is widespread today, is intensified in the case of climate change by the inherent radicalism of necessary responses and fierce partisan conflict.⁴²

A dimension of witnessing, then, is sensitivity to public wariness of expert authority. It underscores the responsibility to explain just why, in each particular case, specialized knowledge is vital to democratic decisions and, at the same time, calls on professionals to demonstrate humility with regard to what they don't know. They publicly demonstrate tolerance for uncertainty and exhibit the capacity for learning and self-correction.

"We can raise our voices . . . and hope to move some minds. But neither the UN nor the pope can force action," Michael Gerrard acknowledges.⁴³ Witnessing aims at moving minds and propelling action. As Jessica Green points out, "We

must remember that policy is not a substitute for politics.”⁴⁴ The authors’ commitments to a certain course of education, warning, and advocacy reflect their judgments of how to best contribute to effective climate action. These judgments are rooted, sometimes implicitly, in their thinking about the political dynamic of change.

Does effective climate policy come, or will it come, from above? From an alliance of political and professional authorities? From executive emergency powers operating outside regular institutional or constitutional constraints? From decisions by national judicial branches? Or from international negotiations or legal structures created by international courts? And who will enforce these decisions?

Alternatively, does the dynamic of constructive political action operate from below? Is the critical mover mass popular mobilization, including protest movements by young people who affirm with John James Audubon that “the world is not given by our ancestors, but borrowed from our children”?⁴⁵ Or does the impetus to political action come from community-level organizing and coalitions of advocacy groups?

Or is the path more complex, running from a combination of popular mobilization and social organization to the creation of stable electoral majorities capable of holding political representatives accountable?

Witnessing professionals differ, as well they might. These essays suggest that no political dynamic can be ruled out. No effort is lost. Every effort enhances our moral self-esteem. One thing witnessing does not countenance is disparaging democratic political agency. Representing humans as a “psychopathic colony . . . of suicidally productive drones in a carbon-addicted hive” expresses frustration, even despair, but it is self-indulgent.⁴⁶ Witnessing is directed at awakening and life affirmation, at harnessing the human capacity for adaptation and innovation, and at actions consistent with democracy.

Yet hope and despair thread through these narratives. Witnessing imposes personal costs. The scientists who rallied and pushed back against deniers of the decline of the Arctic polar bear population were not fired from their jobs, but David Titley bluntly acknowledges the peril: “We now have an administration in which it is hazardous to your career’s health to bring up climate risks in any form.”⁴⁷ Climate witnesses suffer insults, attacks on their reputation, hounding, harassment, and loss of funding. Naomi Oreskes endured violent threats and Antonio Oposa was the victim of a devastating violent assault.

Witnessing professionals also bear the emotional and psychological cost of having their advice and warnings ignored while evidence mounts of how far things have gone wrong. As one researcher whose career is dedicated to studying frogs put it, “We are losing all these amphibians before we even know that they exist.”⁴⁸

Still, the *Dædalus* authors persevere. They exhibit stamina. Scott Knowles confesses, “I’m a disaster researcher, worry is my business”; but worry is not resignation.⁴⁹ Michael Gerrard’s essay is titled “An Environmental Lawyer’s Fraught Quest for Legal Tools to Hold Back the Seas” – a frustrating quest, not a futile one – and Carolyn Kormann’s is “The Coral Is Not All Dead Yet.” Elke Weber practices what she calls “applied hope.” Antonio Oposa leads the Normandy Chair for Peace, which he describes as a search for “the good, the right, and the bright.”⁵⁰ David Titley’s essay on selling climate change inside the halls of the Pentagon – “A Patron Saint of Lost Causes, or Just Ahead of Its Time?” – sits on the knife-edge of despair and hope. The final note Rafe Pomerance strikes in our conversation is pitch perfect: “Shouldn’t I be totally depressed? Yet I’m not. . . . We started at zero. Well, look at us now. Everybody in the world knows about climate change. So is that progress? Let’s hope.”⁵¹ As Robert Jay Lifton concludes, “With climate issues, it is always late in the game and yet, in mitigating potential catastrophe, never too late.”⁵²

Inaction is massive carelessness. It is also a violation of what is right. Antonio Oposa takes stock of the absurdity:

We cut down trees that took all of time to grow, sell them off as lumber, and count them as revenue. We scoop out the Seas to eat fish by the millions of tons, fish that were here long before us. In a matter of hours, we dig out carbon that formed over one hundred million years, and burn it as coal, oil, and gas. In a matter of minutes, we burn them . . . belching out poisonous gases into the very Air we breathe. We take out so much from Earth, use it for a while, and then throw it away as “waste.”⁵³

For most of us, climate change as a whole and the fearful future it portends are beyond imagination. These essays give us grounding. They help us grasp the many-sidedness of climate change and its effects, the next steps, the laws, the business decisions, the regulations and policies and political actions that are within reach. Witnessing professionals show us how to think about and beyond the unthinkable.

AUTHOR'S NOTE

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Dædalus stepped onto the field of climate change in 1996 with "The Liberation of the Environment." "Religion and Ecology" followed in 2001, and two volumes on "The Alternative Energy Future" in 2012 and 2013 focused on solutions. In 2015, "The Future of Food, Health & the Environment of a Full Earth" and "On Water" were published. I am grateful to the American Academy for adding this volume on the experiences of those who do climate work and bring what they know into the public square. Peter Walton and Heather Struntz did expert and speedy work copy-editing these pieces. Phyllis Bendell, Director of Publications and Managing Editor of *Dædalus*, brought her experience as guide and editor, her supreme good sense, and her enthusiasm to this effort; she made this publication possible.

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On Becoming Witnessing Professionals

Robert Jay Lifton

I came to view my work with Hiroshima survivors in 1962 as not only a scientific study but a form of bearing witness to what the bomb did to human beings in that city. I tried to bring professional knowledge and experience to that effort, to become what I later called a witnessing professional. Nuclear and climate issues interacted in that early study, and have continued to be inseparable for all of us. I draw upon examples of witnessing professionals over the course of our struggles with these two planetary threats. In each case, they had to expose and combat the malignant normality, the dangerous prevailing assumptions and narratives, of their time. In that way, these professionals have contributed to important social movements. They have also deepened – as we too can – the ethical dimensions of professional work.

More than a half-century ago, during a period of six months in 1962, I was able to live in the city of Hiroshima, where I interviewed survivors of the first nuclear weapon dropped on a human population. I was intent on carrying out scientific research by rendering those interviews as systematic as possible. I tried to bring the ethical standards of my profession to that work by obtaining consent from those interviewed and remaining sensitive to their psychological state and avoiding any approach that might be harmful to them.

Yet there was an added ethical dimension I was aware of without quite having words for it: that of making known to the world what these survivors told me. This meant taking in as much of their experience as possible and retelling it from a psychological and historical perspective. I would later think of this as bearing witness as a professional to what I encountered in that city. I came to realize that the more disciplined I was in presenting my findings, the more scientific my endeavor, the more effective my witness would be. That witness could be summed up in six words: “one plane, one bomb, one city.”

Of course, my Hiroshima witness had to do with nuclear threat, not with climate. But these two threats have never been entirely separable. Consider the terrifying rumors that spread among survivors immediately after the atomic bomb.¹ All had to do with the Hiroshima habitat. The most persistent of these rumors, and for many the most disturbing, was that trees, grass, and flowers would never again grow in Hiroshima. Because of the bomb’s “poison” – its radiation effects – the city would be unable to sustain vegetation of any kind. Nature would dry up

altogether; life would be extinguished at its source. The rumor suggested a form of desolation that not only encompassed human death but went beyond it.

Hiroshima survivors' sense of a permanently destroyed habitat influenced my own research findings in ways I did not fully realize at the time. Just two or three years ago, an assistant found, among my papers deposited at the New York Public Library, an unpublished article entitled, "Hiroshima and the Ultimate Pollution."² Apparently written in the late 1960s, I used it in talks I gave, emphasizing our new capacity to destroy our natural world. I spoke of the "breakdown of ecological balance" and suggested that we use such terms as "poison," "deterioration," "degeneration," and "starvation." At that time, I had no grasp of work on climate change that scientists were only beginning to carry out. What I did sense was that nuclear weapons posed a profound threat to the larger human habitat.

To be sure, Hiroshima is the most extreme kind of destructive event, one that immediately lends itself to various forms of witness. But we have learned that the effects of climate change can be no less extreme. Scientists have identified some of those effects as very much present in our immediate world and as posing a threat to human civilization over the course of the century. Surely, the situation requires of us an ethic that confronts this threat to the human species and most other species as well. The ethic can emerge precisely from our knowledge as professionals, but must transcend previous ethical rules. That broader ethic enables us to confront truths having to do with the catastrophic destruction of the human habitat, and with ways of preventing or mitigating that looming catastrophe. In general, a witnessing professional both reveals profound dangers and seeks to combat them.

Here we must look at the context of such witness, and its connection with what I call "malignant normality." All societies impose what can be called cultural and social norms, patterns of behavior that are expected of people in various situations, even if the behavior is harmful or dangerous. This can include behavior in basic areas of life such as family, or education, or political or social authority. It can also involve choices of energy sources for sustaining life in the twenty-first century. Professionals tend to adhere to these norms, and even to legitimate and deepen them by means of their professional status.

I came to the concept of malignant normality through my work on Nazi doctors.³ The German doctors I studied were not inherently evil. Most came to their murderous behavior by adapting to Nazi expectations. Like all professionals in Nazi Germany, they had undergone what was called *Gleichschaltung*, meaning the coordination or synchronization – that is, the Nazification – of their profession. That meant removing independent leaders and putting in charge those imbued with Nazi principles of biological purification. Those principles included the victimization of Jews in order to "heal" the Nordic race. When a German doctor assigned to Auschwitz "selected" Jews for the gas chamber, he was doing what was

expected of him, doing his job. When an individual doctor had difficulty carrying out that function, he was subjected to a perverse form of psychotherapy in which an older hand would be assigned to help him with his conflict, drink heavily with him, and encourage him to be stronger in doing what he had to do.

Nor are democracies immune from malignant normality. A dangerous example has been America's sequence of attitudes and arrangements concerning nuclear weapons. From the immediate post-World War II era, nuclear weapons have been viewed by influential American leaders and much of the American population as available instruments for defending our interests and values, for maintaining something we call "national security."

One can identify at least three waves of malignant nuclear normality.⁴ There was first what can be called positive nuclear outcomes, best expressed by the belligerent scientist/strategists Herman Kahn and Edward Teller in their narratives of fighting, winning, and generally achieving military goals by means of nuclear war. Kahn described how an American president might say to advisors, "How can I go to war – almost all American cities will be destroyed?" and receiving the answer, "That's not entirely fatal, we've built some spares."⁵

Psychiatrists brought their mental authority to malignant nuclear normality as part of a 1956 national civil defense panel that included other physicians, social scientists, retired military officers, and additional "wise and mature" individuals. The panel aimed at minimizing fears of the "threat of annihilation" lest these undermine American willingness "to support national policies which might involve the risk of nuclear warfare."⁶

Nuclear normality was imposed on children in the notorious duck-and-cover drills of the 1950s and 1960s, in which kids were told that they could protect themselves against nuclear fallout by putting their heads under a desk or a piece of paper over their heads. Six-year-olds were too intelligent to believe that, but, according to a study done by Michael Carey, a close colleague, many became deeply confused about authority in general and susceptible, years later, to recurrent nightmares involving nuclear war.⁷

A second wave of nuclear normality lent Harvard prestige to rendering the weapons part of the American landscape. With a theme of "living with nuclear weapons," a group at the Kennedy School of Government stressed the prevailing policy of "nuclear deterrence" and the role of the weapons in "just wars." Under some circumstances, the weapons would have to be used and there would be "some risk that 'just war' limits would not be observed." The Harvard group condemned as "emotivists" the most brilliant satirical takes on nuclear weapons: Stanley Kubrick's *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb*; and Tom Lehrer's lyrics: "So long mom, I'm off to drop the bomb / So don't wait up for me." In contrast, the Harvard group offered its own "reasoning."⁸

The third wave of nuclear normality focused on what could be called the grandiose rescue technology of the Strategic Defense Initiative (SDI), or “Star Wars.” Antiballistic missiles were to intercept nuclear missiles to provide what Ronald Reagan in 1983 described as “the means of rendering... nuclear weapons impotent and obsolete.”⁹ The trouble was that the SDI could never offer more than a partial defense, meaning that some nuclear weapons would inevitably reach their targets, and that the policy tended to encourage a first-strike mentality of “preventive” nuclear strikes among the possessors of the SDI who could consider themselves able to blunt a nuclear counterattack.

But from the beginning there emerged witnessing professionals exposing and contesting malignant nuclear normality. The first group of these consisted of scientists involved in producing the bomb, seeking to prevent its use on a human population. One of them, the biophysicist Eugene Rabinowitch, told of walking the streets of Chicago in the summer of 1945 and “imagining the sky suddenly lit up by a giant fireball... skyscrapers bending into grotesque shapes... until a great cloud of dust rose and settled onto the crumbling city.”¹⁰ He and others prepared urgent petitions that the bomb only be used in demonstrations and not on human targets. They were not able to stop the atomic bombing of Hiroshima and Nagasaki, but they provided the origins of the scientists’ movement which, after the war, devoted itself to bearing witness to profound nuclear dangers. There have been many other nuclear witnesses, but the physicians movement, in which I have participated, has considered itself a successor to that of the scientists. As medical professionals, we have had a very simple message: This time we can’t patch you up, help you recover. We’re doctors, we would like to do that, but hospitals will be destroyed, there will be no medical facilities or equipment, and in any case you will probably be dead and so will we. The movement has included Soviet and Chinese physicians in calling upon professional knowledge on behalf of a planetary ethic.

Turning to global warming, we may say that malignant climate normality encompasses everything in our physical and psychological existence. We are born into it and nothing in our lives is outside of it. Potential consequences of global warming lack the world-ending suddenness of nuclear catastrophe, but can be just as apocalyptic. Here we human beings encounter an ultimate absurdity of a kind we have never previously faced. By merely continuing with our present energy practices, especially our routines involving fossil fuels, we will increasingly harm our own habitat, the portion of nature we require to survive, and ultimately destroy our civilization. We needn’t start a war or make use of ultimate weapons. We needn’t do anything other than what we are already doing to endanger the future of our own species, and much of our civilizational destruction will take place within this century. Can there be a greater absurdity than this?

No wonder some psychologists and neuroscientists look for an explanation of this behavior in the wiring of our brains. They claim that our brain function and psychological capacities enable us to deal with immediate threat but not with prospective possibilities. I believe this view to be half-true, and highly misleading. We are surely better at taking in a direct experience than imagining events of the future. But a distinguishing characteristic of the remarkable evolutionary entity we call the human mind is precisely its capacity to imagine what has not yet happened. All the more so when those anticipated catastrophic events have already begun to occur. Misleading claims about imaginative incapacity deepen our malignant climate normality.

Climate scientists differ from their nuclear counterparts in having done nothing as a group to create the problem. But like nuclear scientists, they have done everything to identify the danger: the crucial human contribution to climate change through the promiscuous use of fossil fuels. Climate scientists were at first quite alone in their witness, both in their efforts to make known the dire significance of their findings and to convince others of the necessity to act. A number of contributors to this volume – including Naomi Oreskes, Antonio Oposa, and Robert Socolow – have been leading witnessing professionals in combatting the malignant normality of climate change. A watershed moment in American consciousness was physicist and climate scientist James Hansen’s 1988 testimony before a Senate subcommittee on global warming. Unfortunately, Hansen has since come out strongly, and more intellectually loosely, for a large-scale nuclear energy solution, which suggests that valuable professional witness can be followed up by less disciplined and potentially harmful advocacies.

The good news is that general awareness of climate change has deepened, as demonstrated by various polls and by journalistic and political attention. I speak of this as a “climate swerve.”¹¹ The term *swerve* is as old as Lucretius, and has been used over centuries to suggest a shift in the way people experience their world, as eloquently described by the contemporary humanist Stephen Greenblatt.¹²

One way of understanding that climate swerve is to note a shift from fragmentary to formed awareness, terms I originally used in connection with nuclear threat. *Fragmentary awareness* consists of images that are recurrent but fleeting: pictures in our heads that go from an unprecedented heat wave in one place, a drought in another, coastal flooding in another, and a severe hurricane in still another, without a clear grasp of their relationship or larger significance. *Formed awareness*, in contrast, includes recognition of cause and effect, so that the heat waves, droughts, floods, and severe hurricanes come together in ways that strikingly question previous faith in climate normality. Formed awareness does not guarantee climate wisdom, but is necessary to it. Formed awareness, when widespread, becomes part of a social dynamic, built on climate truths, a basis for constructive action.

The international event that epitomized the climate swerve was the United Nations Climate Change Conference in Paris in November and December 2015. Whatever its failings, that conference was an expression of species unanimity. Rather than legally bound commitments, its greatest achievement may well have been its collective state of mind, its near universal witness to the threatened state we share as members of a single species. From the time of that meeting, those supporting malignant climate normality have been on the defensive, so much so that President Donald Trump has experienced fierce national and international responses to his efforts to extricate the United States from that agreement. His efforts were met with outrage throughout this country, including that of mayors and governors, and with equally strong protest from leaders and officials throughout Europe.

One may now say that climate normality has its own increasing instability. No longer is it possible for anyone, not even Trump, to avoid knowing in some part of his or her mind that climate threat exists. Many suppress and resist these truths because they contradict their worldview, their identity, their party's policies, and their donors' demands. It is more a matter of climate rejection than denial, but that rejection has become politically risky and increasingly difficult to sustain. Hence the recent efforts of some Republicans to find a way of at least minimal acknowledgement of human-caused climate change.

Finally, let me return to the concept of witnessing professionals by saying a bit about historical currents in professionals in general. As early as the twelfth century, there emerged the idea of "professing" one's religious convictions, one's vows as a member of a religious order.¹³ But over the centuries, as society became more secularized and more technicized, there was the formation of professional guilds and societies devoted to perpetuating craft and technique rather than religious faith. So much so that this technical emphasis came to be associated with ethical neutrality. Modern professionals could become hired guns, serving the highest bidder. The development of what we call "professional ethics" has imbued our work with standards of decency, but has in no way addressed the threat to human civilization. Our ethical task now is to extend that "decency" to our species, which we can only do by committing ourselves to preserving it, and preserving other species as well.

That ethic continues to make use of our technical knowledge while "professing" our commitment to humanity. Rather than hired guns beholden to powerful forces, our "sponsor" is all-encompassing human civilization. We are by no means creating a new entity but are drawing upon the history of professionals to express an ethic necessary for our era.

Many have pointed out that it is late in the game to do so, and that is true. But there is an important sense in which, with climate issues, it is always late in the game and yet, in mitigating potential catastrophe, never too late.

I close with a quotation from a Viennese neurologist. Sigmund Freud was notoriously skeptical of human agency, expressing in his works the conviction that we were driven by instinct and emotion. Yet toward the end of his life, he said this: “The voice of the intellect is a soft one, but it does not rest until it has gained a hearing.”

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On Becoming Witnessing Professionals

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What Is the Social Responsibility of Climate Scientists?

Naomi Oreskes

Do scientists have a responsibility to act affirmatively to ensure that our findings are known, understood, and put to use to protect our fellow citizens, even if it means expanding our activities beyond the field and the laboratory? I argue that scientists have a sentinel responsibility to alert society to threats about which ordinary people have no other way of knowing. However, the same expertise that makes a scientist an appropriate sentinel in one or several domains almost necessarily makes them inexpert in other domains. I believe that we should exercise restraint when asked to intercede in areas beyond our proximate expertise.

Many years ago, I read psychiatrist Robert Jay Lifton's work on Nazi doctors.¹ That work has been a touchstone for me in thinking about scientists' social responsibility and how scientists see their place in the world. Among other things, it taught me at an early age not to assume that educated people can be relied upon to do the right thing.

In hindsight, nearly all right-minded people are appalled by the ways in which large segments of the German medical establishment not only failed to oppose Nazi genocide, but participated with Nazi programs to exterminate Jews, mentally and physically handicapped citizens, and others thought by the Nazis to be undesirable. Would American physicians have behaved differently? Would they behave differently today?

Throughout the late twentieth century, more than a few American doctors collaborated with the tobacco industry, whose products are responsible for eight million preventable deaths each year.² Historian Robert Proctor has called this an "Auschwitz an annum," which sounds inflammatory, but is quantitatively an understatement.³ We also know that even doctors who did not work for or with the industry often blithely accepted industry safety reassurances, without making the effort to scrutinize those claims in light of industry intentions and motivations.⁴ Physicians have also collaborated in dubious ways with Big Pharma: historian Nicolas Rasmussen has argued that physician-pharma collaboration has biased clinical trials in ways that favor the drug companies at the expense of good science and patient health and safety.⁵ Historians have collaborated with the tobacco in-

dustry, as well, leading to distortions in our understanding of this history.⁶ And during the Cold War, various social scientists and artists collaborated with the CIA in ways that sat in tension, if not overt conflict, with the goals of objectivity and intellectual freedom. Some scholars who claimed to be working to defend intellectual freedom were in fact engaged in projects that undermined and denied it.⁷

Most scientists, ethicists, and other observers would agree that scientists should not participate in morally dubious activities, nor engage in collaborations that undermine academic freedom and objectivity. These are, as ethicists would say, negative considerations: things we should not do. But what about positive considerations? Do scientists have an obligation to speak out against dubious practices, or to call public attention to threats to public health and well-being? Is it enough to do good science and publish it in reputable peer-reviewed journals, or do scientists also have the obligation to be witnesses, testifying to matters that they as the relevant experts are uniquely positioned to observe, understand, and explain to the rest of us?

A famous example from the earth and environmental sciences involves the ozone hole. In the 1990s, atmospheric chemist Sherwood Rowland shared the Nobel Prize for his work predicting that chlorinated fluorocarbons could destroy stratospheric ozone, endangering the existence of life on Earth. But Rowland was not just a great scientist; a decade before, he had become a public figure, not only alerting the public and political leaders to the threat but insisting that something needed to be done to address it. As an expert who understood the cause of ozone depletion, he considered it obvious that the solution was to control the chemicals that had caused the problem. Not surprisingly, he was criticized mightily by the chemical industry.⁸ But he was also criticized by scientific colleagues who took issue with his “activism.” Rowland knew as much about ozone as anyone, yet some colleagues argued that he should be excluded from ozone science assessments, because his activism undermined – or could be viewed as undermining – the objectivity of the process (even though the assessment panels sometimes included industry scientists).⁹ Rowland’s response to this was to ask: “What’s the use of having developed a science well enough to make predictions if, in the end, all we’re willing to do is stand around and wait for them to come true?”¹⁰

What is the point of researching issues that involve public health and safety if we are afraid to warn the public, for fear that we will be viewed as biased? How can politicians or other leaders act on pertinent science if scientists don’t inform them about it? Is the obligation of scientists simply to do the best science possible and leave it to others to explain, publicize, and act upon? Or do scientists have a responsibility, as Rowland believed, to act affirmatively to ensure that our findings are known, understood, and put to use to protect our fellow citizens, even if it means expanding our activities beyond the field and the laboratory?

I come to this issue having faced these questions in my own work, both as a geologist and as a historian. My original training is in Earth science. I earned an undergraduate degree in mining geology, choosing that specialty because I liked its real-life, dirt-under-your-fingernails, shower-after-work quality, and, not incidentally, I wanted to be able to get a job when I graduated. (I also wanted to travel.) I worked for three years as an exploration geologist in the Australian outback, where I helped to evaluate and develop a large polymetallic ore deposit. One of the metals in the deposit was uranium, and my company came under a great deal of scrutiny from Australians opposed to nuclear power. There were protests at our site. Antinuclear activists camped out around the drill rigs that I was supervising.

This was in the early 1980s and the anticipated customer for our uranium was Japan. While I wasn't entirely convinced of the universal virtues of nuclear power, I did think it was a reasonable option for that country, which had few other obvious energy resources. No one I knew in the mining industry seriously doubted that civilian nuclear power was a reasonable thing to pursue, and therefore that uranium mining for it was likewise reasonable, but I encountered some very negative reactions from people I knew outside the industry. Many people questioned the allegedly sharp distinction between civilian nuclear power and nuclear weaponry, and considered it not unlikely that at least some Australian uranium would end up in bombs. More than a few folks blamed me, personally, for things they didn't like about nuclear power. Some people I met – at parties, at dances, on vacation – could not *believe* that I would actually work for a uranium mining company. I remember one party in Melbourne, where a nice young man asked me what I did for a living. When I told him, his reply was: “Really? *REALLY?*” “Yes, really,” I said, and there the conversation ended.

That was my first personal encounter with the issue of the social responsibility of scientists. I sat at the lowest possible level in my company. I had no executive authority. But many people acted as if I were personally responsible for the ills of nuclear power and nuclear weapons (often combined, rightly or wrongly, in people's minds). In some ways they were right. While I was a low-level employee in a position of no authority, if I worked in uranium mining, then I did bear some responsibility, however small, for the consequences of nuclear technologies. My job was at the base of the nuclear fuel cycle: doing the basic science that enabled our company to find and mine uranium ores, to be processed in nuclear fuel rods used in nuclear reactors.

I took on board the responsibility to become educated about nuclear power. The more I learned about the history of American nuclear power, including its two central failed promises – of electricity “too cheap to meter” and of easy waste disposal – the less persuaded I became that it made much sense, particularly in the United States where we had other, better options. I didn't think that nuclear pow-

er was *evil* – and I still don't. I believed that the distinction between reactor-grade and weapons-grade fuel was pertinent: the uranium ore we were mining could not be easily converted to fuel for a bomb. But I realized that there were many significant unanswered questions, and that people's discomfort with nuclear technologies was not irrational. In particular, I learned that the U.S. government had a long history of lying and dissembling on matters nuclear, as well as overstating the promise and downplaying the risks of civilian applications. And then, in 1986, the Chernobyl nuclear disaster occurred.

Many American scientists insisted that the Chernobyl disaster wasn't "relevant" to the safety of American and European reactors, because the accident had happened in the Soviet Union, which was obviously corrupt, and because the reactor was a graphite-cooled one, a dangerous design that was not used in U.S. commercial reactors. Meanwhile, I had moved on to graduate school, where I was in the process of becoming a historian and philosopher of science. Nuclear power generation more or less faded as a pressing issue from my life, although I tracked the progress (or lack thereof) of the proposed nuclear waste repository at Yucca Mountain, where many geologists were then employed.

I also made a surprising discovery, one that revealed to me how closely the nuclear fuel cycle was intertwined with American science, writ large. As part of my Ph.D. research, I undertook geochemical modeling of the ore deposit on which I had worked in Australia, only to discover that there was surprisingly little high-quality thermodynamic data available for common minerals in our ore deposit, including quartz (SiO_2) and hematite (Fe_2O_3), yet astonishingly good data for rare and obscure lanthanide and actinide series minerals. The reason? The latter had been closely studied by the U.S. Department of Energy for their pertinence in nuclear waste disposal. Thus, I developed an early insight into how political considerations shape what we do and don't know about the world.

Fast-forward twenty years. I am now, in the mid-2000s, a historian working at the University of California on the history of climate science. As I began to write and speak about the scientific consensus on climate change, I was personally attacked. I started to receive hate mail and threatening telephone calls. A group of people filed complaints against me, challenged my work, and tried to get me fired from my job. A senator from Oklahoma, of whom I had at that time never heard, accused me of being part of a "liberal conspiracy to bring down global capitalism." This was all very odd. All I was doing – in my own mind – was explaining the state of the science. But others did not see it that way.

That was a frightening time, far more troubling than what I encountered in Australia. In Australia, I knew that my company – rightly or wrongly – would be influenced not one iota by bedraggled, antinuclear protesters. I did *not* know whether the University of California would be influenced by my attackers, in part

because largely I did not know who they were and the one I did know was a U.S. senator! Moreover, in Australia, I considered it possible that the protesters were right. But in California, I knew, for sure, that the attacks on science that I was uncovering were deeply wrong. I knew I had discovered something important. I realized that if someone was trying to shut me down, it meant I had to stand up. But I would be lying if I didn't admit to more than a few sleepless nights.

I share this personal story to make clear that I understand and sympathize with colleagues who want to lay low. In Australia, it would have been easy simply to say to myself, "that's above my pay grade." In California, it would have been safer to retreat. Moreover, it's not just a matter of safety. Most scientists just want to do science. It is what we trained to do. It is what we are good at. On some level, it is who we are. But the world sometimes forces us to make choices that no one prepared us for.

When I got attacked, I could have been frightened and intimidated. I was frightened. But I also realized that something significant was going on. One thing that made a difference for me (in addition to the fact that the University of California did stand by me) was that I soon learned that I was not alone. Several climate scientists had been attacked, too. It helped that I was a historian as well as a scientist, because I began to think about what was happening to me not in personal terms, but in historical ones: Why am I (and others) being pressured when we speak up about the facts of climate change? Where is this coming from and who are these people? Why would a senator from Oklahoma attack a historian of science over a paper in a peer-reviewed journal? Most scientific papers never even get read; why had mine loosened a torrent of political abuse?

There are different ways that we can respond to outside pressure, and in the past few years I've tried to understand why scientists respond in the ways that they do. In particular, I've tried to understand why it's been so difficult for most of my scientific colleagues in the Earth sciences to respond in efficacious ways.

I now think that scientists are different from other professionals in that other professionals have *clients*. Physicians have patients. Lawyers, psychologists, and engineers have identifiable clients paying for their time. These professionals all recognize some kinds of obligations, often articulated by professional codes of conduct. According to these codes, certain forms of public statements or actions may be disallowed or, alternatively, obligatory. Often these codes of conduct are historically linked to professional licensing arrangements. A physician who egregiously violates medical norms can lose her license, a lawyer can be disbarred, an engineer can be decertified. But in science, although we may have identifiable patrons, we don't have clearly identifiable clients. And, with some exceptions, we don't have formal licensing agreements. Perhaps for these reasons, we have few

formal codes of conduct that govern our behavior. Scientists are for the most part left to our own devices to figure out how to behave.

Scientists can be discredited, but there's no *formal* means to exclude, dishonor, or shame a scientist who has misbehaved (or might be construed to have misbehaved). In most cases, there's no formal code of conduct that enables us to say that a scientist has transgressed. However, and perhaps for this reason, scientists are very sensitive to their community norms. In my experience, scientists tend to be extremely sensitive to the opinions of their colleagues, more than to any sense of obligation to funders or to society as a whole. Many scientists, for example, have told me that they are cautious in what they say about climate change for fear of damaging their reputations. The harm they fear is not public censure, but *collegial disapproval*, and they anticipate that disapproval to arise primarily from speaking up, grandstanding, or overstating a threat. The societal harm that may come from understating a threat seems (in most cases) to be of much less concern.¹¹ Perhaps a lack of formal codes of conduct makes scientists more sensitive to community norms than other kinds of professionals, because community norms are all that scientists have.¹²

These concerns came to the fore in my work with climate scientist Michael Oppenheimer and philosopher Dale Jamieson on scientific assessments for environmental policy. We found that earth and environmental scientists are highly attuned and sensitive to community norms and fearful of collegial censor. When we asked scientists about speaking up in public, many said things along the lines of: "I'll lose credibility." But with whom do they fear losing credibility? Our evidence suggests it is not the public (whoever they conceive that to be), nor political leaders, but their professional colleagues.¹³

As a cautionary tale, many climate scientists point to climate modeler James Hansen, who first testified in Congress in 1988. They say things such as, "Just look at Jim Hansen." (I can remember colleagues in the late 1980s and early 1990s criticizing Hansen for being too vocal, too public. Many thought he had gone "out on a limb.") Hansen himself has criticized his colleagues for reticence, which he has identified as a community norm.¹⁴ But I know of no evidence that the public at large considers Hansen to have lost credibility when he became a public figure. On the contrary, to many in the public today, Hansen is a hero.¹⁵ He is almost certainly the most well-known of climate scientists. And he has won innumerable prizes, of both the scientific and the public sort. In 2007, for example, he won the Dan David Prize, a sort of Nobel Prize in areas not recognized by the Nobel itself. This hardly suggests a loss of public credibility.

Why should scientists involved in environmental assessments criticize colleagues who speak out on environmental matters? After all, these assessments exist to inform public policy on issues that potentially affect large numbers of people, or even the entire population of the planet. Surely, the very fact of participat-

ing in such an assessment implies a sense of larger obligation? In theory, perhaps, but we have found that scientists do not generally express a strong sense of obligation to the entire population. (And sometimes they express no sense of such obligation at all.) They do, however, express a strong sense of obligation to each other, and to their disciplines. I think this explains why Hansen bothers them. Climate scientists see Hansen as someone who stepped outside the fold: he called attention to himself, sounded an alarm, and didn't wait for the rest of his colleagues to reach the same conclusions that he had reached.

Science is a collective enterprise in which scientists attend with great seriousness to the work and conclusions of their colleagues, for it is through this attention that scientific questions are mooted and resolved.¹⁶ This is what makes science reliable, but it can also make scientists behaviorally conservative. They are always metaphorically – and sometimes literally – looking over their shoulders to see what their colleagues think.

Another line of argument relating to scientific responsibility emerges from my work on the history of Cold War Earth science, and the role of U.S. Navy funding of oceanography and marine geophysics during World War II and the Cold War.¹⁷

During the twentieth century, there was a major change in how earth scientists interacted with people outside of their discipline. Before World War II, most American earth scientists were poorly funded; what little funding they had came from state governments, private philanthropy, private industry, or from the public through book royalties, payments for magazine and newspaper articles, and public lectures. Scientists who wrote popular books or gave public lectures had to find ways to communicate to nonspecialists. They had to be concerned with public interests and opinions.

During the war, however, this changed, and in the late 1940s and 1950s, the rise of scientific research support through specialized federal government agencies such as the National Science Foundation, Defense Advanced Research Projects Agency (DARPA), and the Office of Naval Research made scientists less dependent on the general public and more dependent on governmental patrons. This shifted their sense of where their obligations lay. Moreover, these postwar agencies often had program directors who were themselves scientists. Increasingly, scientists obtained funding from programs that were designed by scientists, and in quite a few cases, run in part by scientists. Many American scientific communities became what historian Paul Edwards has called “closed worlds,” in which the demands of military secrecy limited their interactions with people outside those worlds, and even with other scientists outside their fields of specialization.¹⁸

As the Cold War progressed, scientists increasingly worked in these closed worlds. They had far less interaction with general publics (and even with scien-

tists in other fields) than they did before World War II. The Cold War also created a context in which speaking up about certain kinds of threats could be perceived as disloyal. Many scientists in the Cold War came to feel that if they spoke up against American weapons programs, for example, that would be perceived as being disloyal to *America*, which famously happened to physicist J. Robert Oppenheimer.¹⁹

These conditions have left a lasting legacy. One example is documented in my forthcoming book *Science on a Mission: How Military Funding Shaped What We Do and Don't Know about the Ocean*. It involves a major controversy that erupted in the 1990s, when physical oceanographers proposed a project to demonstrate global warming by measuring the warming of the oceans. These oceanographers had a long history of collaboration with the U.S. Navy, but no history of engagement with environmental groups and scant engagement even with biologists. Perhaps for this reason, they failed to consider the effects that their project might have on marine life. This led cetacean biologists – along with many others – to oppose the project. The oceanographers also failed to realize that, because it could adversely affect marine life, their proposed project might violate the law (specifically the Marine Mammal Protection Act). A consortium of environmental, community, and animal protection groups filed a lawsuit to stop the project. And they succeeded. Although the project might well have been valuable scientifically, it was stopped.

The physical and intellectual isolation of Cold War oceanographers affected their sense of the scope and character of their responsibilities, and to whom they thought they had obligations. Physical oceanographers working with the U.S. Navy understood that they needed Navy approval – for funding, for the use of instrumentation, for access to infrastructure – but they failed to consider that they also needed the approval of scientists in other fields, of environmentalists, and of the public. They even failed to consider that they needed to obey the law! When they took on the task of measuring the temperature of the ocean, they did so in the name of “society,” who, they insisted, needed a definitive answer to the question of whether the planet was warming up. But their approach failed because it was insensitive to what “society” as a whole really wanted. Some parts of society didn't want an answer to the question, and many of those who did didn't want it in the form that scientists were offering.

The available evidence suggests that the group to whom natural scientists feel responsible – and whose censure they fear if things go wrong – is not society, but fellow scientists, and, more specifically, scientists in their own discipline. This accounts for the reticence about which James Hansen has complained and that my colleagues and I found in our own research: scientists are afraid to speak out on policy-sensitive issues lest their colleagues criticize them for it. But it also puts them in an awkward position: the public or policy-makers

may want scientists to tell them clearly if something dreadful is about to happen, but scientists are often afraid to do so lest their colleagues disapprove.

What many scientists fail to appreciate, however, is that our views of the appropriate role of science and scientists are historically contingent. During the Cold War, many distinguished physicists, including Hans Bethe, Niels Bohr, Albert Einstein, and Philip Morrison, spoke strongly about the risks of nuclear proliferation, and many argued the need for arms control. These men were highly articulate spokespeople who helped to shape the public conversation over nuclear weapons. They were able to do so, in part, because their expertise *qua* physicists gave them a particularly acute appreciation of what an uncontrolled arms race would lead to.

Now, a new set of issues have come to the fore, but the basic situation – of an existential threat that scientists are in a position to understand and explain – is comparable. Physicists served as sentinels in the Cold War; climate scientists are serving as sentinels now. And that, in my view, is as it should be, because scientists do have a general obligation to the society they serve, particularly when our research is taxpayer funded. In the United States, that is most basic research, and a good deal of applied research, too. It includes scientists working in national laboratories and federal agencies, and most scientists working in academia. In that sense, we *do* have clients, and they are the American people. To the extent that we justify our work by its value to humanity, then our clients are all humanity.

This obligation, in my view, includes education and communication, with which most scientists are reasonably comfortable if they get the right institutional support. But there's a more specific obligation. It is what I have called the sentinel obligation.²⁰ It is, in effect, a duty to warn.

Many areas of scientific research are of interest and significance primarily, or even exclusively, to other scientists. But not all. There are certain kinds of problems in the world that matter profoundly beyond the halls of science, but we would not know about were it not for scientific expertise. Think again about Sherwood Rowland and the ozone hole. If he and his fellow atmospheric chemists had not spoken up to alert us to the possibility that chlorinated fluorocarbons could deplete stratospheric ozone, we would not have known that was the case, and we would not have had the Montreal Protocol.

Now imagine the following scenario. Fast-forward fifty years. Physicians have noted that the rate of cataracts and skin cancer is skyrocketing. Horticulturalists have noticed that certain plants are exhibiting strange pathologies. Farmers have noted increased livestock mortality and decreased crop yields. These alarming phenomena are noticed by different experts and lay people, and at first no one realizes that they are part of a single story.

At some point, however, someone suggests that they might be related, or at least the skin cancers and cataracts, since these are known to be caused by exces-

sive exposure to ultraviolet radiation. A commission is empaneled, perhaps at the National Academy of Sciences. The commissioners dig through the scientific literature and they find that, in 1979, Sherwood Rowland, Mario Molina, and Paul Crutzen predicted stratospheric ozone depletion, which can cause exactly the effects now being observed. However, the scientists had only ever published their work in scientific journals, so the public and political leaders never learned of it and therefore nothing was done. Now, fifty years later, it is too late to fix. The world must scramble to build a new form of wholly indoor life, or invent UV protective clothing or some other means to live on a now very dangerous planet.

Fortunately for us, Rowland and his colleagues did speak out. They acted as sentinels – alerting us to an imminent danger – and our political leaders acted successfully to avert the threat and protect life on Earth. Disruptive climate change is bigger and more difficult to solve than the ozone hole, but the ozone example demonstrates the essential role that scientists play as sentinels. Scientists need to be sentinels on emerging problems about which ordinary people have no other way of knowing. They *must* do this; there is no one else who can.

How far should scientists go in accepting a public role? Once one adopts a sentinel role, one will likely soon face the question: “So what do we do about it?” Then things get more complicated. There is an enormous temptation to answer that question, because there you are. You are being asked and of course you have an opinion. If you’re a scientist, you may think that you are a good deal smarter and better informed than most citizens. And perhaps you are.

But if you are a natural scientist, then the very expertise that enabled you to be a sentinel also makes you *unlikely* to be an expert about the solutions, which often are largely legal, technological, economic, regulatory, or otherwise social. Solving the problems that natural scientists identify usually means passing the baton to other experts. Thus, my colleagues and I have introduced the concept of *proximate expertise*. As professionals, we have expertise that makes us the appropriate individuals to speak up on particular challenges, problems, and threats, but that very expertise means that we will typically not be experts on other matters. On those other matters, we should in most cases exercise restraint.

For example, as a geologist/geochemist, I have some degree of expertise to talk about carbon sequestration, because I know quite a bit about how carbon dioxide reacts with water and rocks in the subsurface. I also know something about the problem of overpressuring of the subsurface. In fact, I know more about these matters than many climate modelers. Expressing a view on carbon sequestration could, therefore, be viewed as within my range of proximate expertise. As a person with broad knowledge of the Earth sciences, I might have a well-informed expert opinion on solar radiation management, as well. However, I am not an expert about many other possible questions related to the solutions to climate change.

As a historian, I may have insights into how certain proposed solutions are likely to work or fail, or what it might take to generate broad support for them. But I am certainly not an expert, for example, on carbon pricing systems. For that, I need to turn to other people.

An obvious cautionary example of scientists disrespecting the boundaries of expertise appears in my work with historian Erik M. Conway. In *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming*, we showed how a group of prominent physicists rejected the conclusions of their colleagues in public health and oncology to make common cause with the tobacco industry and cast doubt on the science that demonstrated the harms of tobacco use. From there, they went on to cast doubt on the science that demonstrated a set of other environmental and public health threats: acid rain, the ozone hole, and global warming. In our book, we argue that the range of sciences across which they spread doubt should have been a red flag to any onlooker: no one could be a credible expert on so many different topics. The fact that they cast doubt on science in scientific findings in radically diverse domains was a “tell” that they were motivated by something other than their own scientific knowledge and expertise.

Expertise is by definition specific, and so the obligation to speak up in our areas of expertise implies a reciprocal obligation to respect the expertise of others. Put another way: we have obligations both to speak and to listen. We need to speak up, to act as sentinels, and to be witnessing professionals in our domain of expertise, but we also need to act with respect for colleagues who are the appropriate witnessing professionals in other domains.

This is not to say that as scientists, we give up our rights as citizens when we earn our Ph.D.s. As citizens, we will all have views on many matters and we are always within our rights to comment, talk, discuss, and vote according to our views. Moreover, sometimes it will be appropriate for us to stand up and be counted as both citizen and scientists, for example on matters that involve defending science, or the environment, or public health generally.

Expertise, moreover, is not an either/or proposition; there are areas about which I know a great deal, areas about which I know more than the average person but less than the experts, and areas about which I know very little. It can be tempting to express opinions, particularly in that middle domain, even when it would be better to refer people to others with greater expertise. It requires humility and mindfulness to exercise appropriate restraint, particularly when others press you for an answer.

What I am proposing is admittedly not always easy. I have had the experience of trying to refer journalists to more appropriate experts, only to have them insist that I was the “name” in their Rolodex, that they did not have time to make an-

other phone call before their 5 p.m. deadline, or even that they needed a quotation from someone in the “Ivy League.” (One reporter once told me that if he quoted someone at Harvard who turned out to be wrong, his editor would be unvexed, but if he quoted someone from the University of Oklahoma who turned out to be wrong, then he’d face a pile of questions about why he had quoted that person.) This is laziness, against which we should push back. Even when journalists resist, I often say, “Look, I’m not an expert on that issue, but my colleague, Irene Doe, is. Please call her. Here is her number.” Besides being the right thing to do, it also reminds my interlocutors that expertise is a complex thing. If we really want to understand and solve any problem, particularly one as multifaceted as climate change, we must employ all the expertise that we have.

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Witnessing for the Middle to Depolarize the Climate Change Conversation

Robert H. Socolow

Witnessing for the middle seeks to depolarize contentious public issues and to create effective coalitions. It reveals neglected facets of a problem, clarifies the stakes, reduces hype, and facilitates the engagement of people largely on the sidelines. Regarding climate change, many forms of middle-building are under way, notably including the scenario-making that reveals alternative pathways to some specific goal. This essay explores two additional vital middle-building conversations, both focused on the goals themselves. One conversation addresses how to learn faster about how our planet can harm us. The other conversation focuses on the various ways that we can harm ourselves while pursuing nominal solutions to climate change. The two themes are complementary. The more plausible the risks of dangerous climate change, the stronger the case for risky solutions.

The title of this *Dædalus* issue is “Witnessing Climate Change.” I presume “witnessing” in this instance to be the secular form of a religious concept, requiring forceful speaking or writing that promotes action on behalf of some societally significant issue.

Usually, I think, people would call someone a witnessing professional only if he or she is taking what is regarded at the time as a radical position and is accepting personal risks. Jim Hansen alerting the U.S. Congress to global warming in his 1988 testimony is an apt example of a witnessing scientist. So, too, is Linus Pauling leading the campaign in the early 1960s to stop atmospheric testing of nuclear weapons because of the inevitable negative consequences of radioactive fallout. And Sherry Rowland and Mario Molina in the mid-1970s pressing the case for banning production of chlorofluorocarbons, a popular class of specialty chemicals then widely perceived to be benign, that they realized would destroy stratospheric ozone.

In all three cases, these spectacular interventions required stepping into a void. But what if the subject at hand has already been extensively debated and the conversation has become highly polarized? In such situations, there is value in a different kind of witnessing, “witnessing for the middle.” It is witnessing, because it is provocative and disruptive, and its intent is to drive social change. But

it does not require advocating what at the time are considered extreme positions. Instead, witnessing for the middle searches for new ground: fresh conversations where neglected facets of the problem can be revealed. This middle-building is not an end in itself, but a lubricant. Its objective is to facilitate involvement on the part of people largely on the sidelines, so as to produce a more widely shared, fuller understanding of a problem and, thereby, to diminish polarization. Middle-building can become self-reinforcing.

One goal of this essay is to expand the conceptualization of witnessing so that “witnessing for the middle” is included.

In the case of climate change, two packages of ideas are in contention. Greatly oversimplifying, in one package, the goal is to stave off imminent disaster, and the move away from fossil fuels cannot be too fast; fortunately, there are specific attractive solutions at hand, notably solar power, especially in its distributed rather than its centralized form. Moreover, success may well bring a desirable shift away from consumerist values toward what used to be called “voluntary simplicity.” In the other package, dangerous climate change is distant, even inconceivable, so there is no urgency whatsoever; economic growth based on coal, oil, and gas is tried and true; alternatives can prosper only with excessive government intervention; and if a move away from fossil fuels must, after all, prove necessary, centralized energy solutions – especially nuclear power – are the preferred technologies. Amory Lovins, a leading energy analyst for the past half-century, labeled this polarity the “soft” versus the “hard” path in his classic 1976 essay in *Foreign Affairs*,¹ and the polarity is still very much with us.

Important middle-building efforts to reduce this polarization have been in place for decades. One major effort, not the subject of this essay, promotes the visualization of alternative “scenarios” (pathways to the future) that mitigate climate change to some specified extent. In these scenarios, strategies evocative of both the hard and soft paths gain and lose market share as their costs evolve, decade by decade, perhaps out to 2050 or 2100, often in the presumed presence of a policy that imposes a rising price on greenhouse gas emissions. Technologies of energy supply and use are always modeled, but often nowadays so is the food system, as well as technologies that deliberately remove carbon dioxide from the atmosphere. A scenario can apply to a corporation, a city, a country, or the world. The result is what scientists call an “existence proof,” the discovery of what would need to be done. Scenarios have brought climate change to many new audiences.

My interest in this essay is to explore two other middle-building exercises, less appreciated but crucial for finding our way forward. They illuminate not what is required to reach some goal but the merits of the goals themselves. How can we decide whether a goal is too strict or too lax? To answer this question requires understanding two kinds of risks with opposite implications: the risk that the earth is extremely sensitive to what we do day-to-day (the higher this risk, the more

stringent the targets we should strive for) and the risk associated with our solutions going wrong (the higher *this* risk, the stronger the argument for more modest objectives). Together, the two complementary themes capture the reality that climate change above all requires risk management, including hedging against both kinds of risks.

The first of these conversations addresses the urgent need for climate science to become more ambitious. (I mean “climate science” to encompass all fields that bear on the physical and biological features of the planet relevant at the global scale, including the many implications of human activity; increasingly, this domain is also called “Earth systems science.”) I have two kinds of ambition in mind: 1) giving priority to the hard question of how quickly very bad outcomes could show up (like fast sea level rise) and 2) recruiting large numbers of researchers now working on fundamental problems in many relevant areas (chemists, physicists, computer scientists, experts in control theory, to give four examples) but so far showing little interest in climate change.

The other conversation is about the dark side of “solutions” to climate change and the need for vigilance. For precision, the conversation needs a time frame, which in this essay is the next ten to twenty years. In that period, several strategies to combat climate change (notably, nuclear power, land managed for carbon, and geoengineering) could create havoc on a par with climate change itself, if implemented heedlessly.

A modern version of the Hippocratic Oath provides a metaphor for the two-sided reasoning this essay seeks to encourage: “I will apply, for the benefit of the sick, all measures that are required, avoiding those twin traps of overtreatment and therapeutic nihilism.”² In medical treatment, many of us are acquainted with such fateful choices: A drug with promise has strong side effects. Administer it, or opt for another drug less likely to succeed but with milder side effects?

There is some irony in middle-building exercises that are explorations of extremes. Yet the argument is quite general: people will agree on the importance of anticipating the worst that can happen. Such concerns bring people together in times of war.

The middle-building bearing on climate change that I am recommending must not be construed as an excuse for delay. Addressing climate change aggressively is an urgent matter. “It is essential to know more” does not imply “wait for more information.” Rather, the question I am posing is: what else could we be doing that is likely to be productive?

By emphasizing the importance of exercises that invite heterogeneous participation, I am countering the view that building a “movement” is a sufficient strategy for limiting climate change. A movement intentionally creates polarization, because, as Gus Speth, one of my generation’s most effective environmental leaders, explained to me, it “needs victims and villains.” It is deeply judgmental. A

climate change movement would be self-defeating if it were to stifle a critical and more embracing public discourse.

We need both middle-building and movement-building. They complement each other. As many of us learned from protesting during the Vietnam War, only when the near-left finally joined the far-left could the war be stopped. Witnessing on behalf of instant dramatic action on climate change has been productive: it has primed the pump. To bring about forceful and coherent activity going forward, however, I believe that witnessing for the middle will be essential.

Where am I coming from? I have engaged with climate science and climate solutions in numerous ways over the past half-century. In 1971, in my early thirties, I left a faculty job in theoretical physics (quarks) at Yale for a new faculty position in Princeton University's School of Engineering and Applied Science. I had become fascinated with the idea, then completely new to me, that we humans are changing our planet in immensely disruptive ways by doing ordinary things. I committed myself to following this idea wherever it led. The job at Princeton, newly minted, came with the expectation that I would invent interdisciplinary research related to energy and the environment. I have focused on solutions to climate change, including energy efficiency, nuclear power, wind and solar power, and low-carbon energy from fossil fuels. I have ranged widely across the university, problem-driven rather than discipline-driven. For the past two decades, my office and academic home have been in the Princeton Environmental Institute, a university-wide multidisciplinary unit dominated by climate science.

I trace my need to witness to my secular and religious schooling: a progressive high school run by the Ethical Culture Society and an iconoclastic Hebrew School run by the Jewish Reconstructionist Society, both committed to fostering nonconformity and the student's social conscience. Moreover, Reconstructionist Judaism, which affirms a rebellious blend of modernity and tradition, taught me to cultivate the middle. My fascination with global issues was fostered by a year-long travel fellowship spent in Asian and African countries transitioning to independence. My skepticism when I confront advocacy on behalf of some solution to climate change derives from being a lawyer's son who heard repeatedly: "My job is to help my client think about what he does not want to think about. If something can go wrong, it will go wrong." As for my specific conviction that fresh conversation can transform knotty problems, please allow me to tell four stories (one paragraph each).

My initiation into environmental problem-solving in 1969 centered on the conflict between developers seeking to build a major international airport halfway across the Florida peninsula west of Miami and environmentalists determined to protect the flow of water to the Everglades at the peninsula's southern end. My

contribution (together with my then Yale physics colleague, John Harte) was to highlight the interests of other land developers: those who were about to create cities on the peninsula's west coast that would require substantial inland standing water to protect their water supplies. The jetport would jeopardize such water reserves. When they and other Gulf Coast interests weighed in, President Nixon decided against the airport and, in 1974, the 720,000-acre Big Cypress National Preserve was established instead.³ In the language of this essay, a middle-building exercise had broadened the discussion and had enabled more of those with a stake in South Florida to imagine alternative futures.

My first multidisciplinary project at Princeton in the 1970s was one of the earliest field studies of energy use in mainstream residential housing.⁴ We sought to understand the roles of design, construction, and occupant behavior by instrumenting actual homes. We deliberately chose average buildings – in this case, recently built row houses for middle-income families – which led to our group being attacked from two directions. The architecture community was dismayed that we were not studying the distinctive buildings that architects design, buildings that have enduring significance. Advocates for social justice told us it was close to immoral not to focus on the housing of the poor in inner cities, where the needs were so compelling. I answered that we hoped to contribute toward reducing the total energy use in all buildings, and ordinary buildings dominate that total. Indeed, our project stimulated a fresh conversation about energy use in buildings that spawned a major national effort to develop higher performance windows, lighting, and appliances in every kind of building. It also prodded electric and natural gas utilities to include feedback to the customer (graphical comparisons of present and past consumption, for example) in their monthly bills, which has raised awareness.

Starting in 1983, with several others, I organized a decade-long collaborative project with Soviet (and then Russian) counterparts focused on efficient energy use in buildings and industry.⁵ The impetus for that project was President Reagan's speech calling the Soviet Union an "evil empire" and communism "the focus of evil in the modern world." In that speech, I foresaw the beginnings of a process that would demonize Russians and gradually reduce our inhibitions against obliterating them. I recalled jumping off small rocks in Central Park in Manhattan at age six or so, with my two index fingers pulling my eyelids outward, shouting "banzai," as we American boys were being carefully taught to demonize the Japanese. Scientists on both sides, similarly frightened by the invocation of "evil," developed fresh conversations, of which this was just one example. Our project led to some new energy-efficiency initiatives in the Soviet Union. In the United States, we needed to defend ourselves against charges of helping the enemy.

From 2000 until 2019, I codirected (with Steve Pacala, an ecologist) a large university-wide research program sponsored by BP, a major oil company. Some envi-

ronmental activists are baffled that I enjoyed working with BP and continued the relationship in spite of the 2010 Deep Horizon accident and oil spill. The payoff for me has been the opportunity to influence BP's executives. My colleagues and I provide a safe place for them to ask basic questions, and we provide a counter-narrative that refutes what they hear in industry settings. Their visits to Princeton almost always include a tour of the walk-in freezer with ice cores from Antarctica that chronicle, in their trapped bubbles of old air, the oscillations of the atmospheric carbon dioxide concentration through the ice ages. We inoculate these business leaders against their own credulity, and they begin to modify their company.

These four middle-building experiences lead me to believe that the two risk-focused exercises I briefly introduced earlier will be similarly effective in generating fresh conversations that lead to social change. I elaborate first on dangerous feedbacks in the earth system and then on misdirected climate solutions.

If the world addresses climate change forcefully, nations will spend trillions of dollars over the next few decades to overhaul the world's current energy system and to repurpose the current uses of land. We are preparing to swap an energy system that currently is 80 percent coal, oil, and natural gas, in favor of one in which these fuels become minor players. We are considering dedicating current pastures and farmland to energy crops and harvesting solar energy and wind at nearly continental scale. We are creating plans to relocate coastal communities. We are taking the first steps toward placing the control of climate change into our own hands ("geoengineering" the planet).

It is truly remarkable that at a time when such monumental transformations could lie in our immediate future, there is hardly any strong advocacy for deepening our understanding of how we are affecting our planet: not even for additional satellites, more probes of the deep ocean and glaciers, more sensors in the forests. Normally, when a corporation takes on a new line of business, it develops a research capability to buttress its new investments. And when a country develops new allies or enemies, it spends heavily on understanding their cultures and languages. But for climate change, the urgency of substantially improving the knowledge base is scarcely part of public discourse today. The complacency about climate science is anomalous.

To be sure, climate science already captures our planet's behavior well enough to motivate decisive action. Nonetheless, climate science at present can only partially delineate what is in store for us. Severe climate change could show up slowly or quickly. This is the clear message of the reports of the Intergovernmental Panel on Climate Change (IPCC), which summarize the state of the science roughly every six years. The IPCC repeatedly warns us that far less is known than would be desirable about the amount of climate change the world will be contending with a decade from now, and half a century from now. Even when human contributions

are fully specified, the worst and best plausible outcomes for the future of humanity consistent with current science are very different.

When the stakes are so high, why is the climate science enterprise so nearly invisible to the public, and why does it have so few champions? A partial explanation lies in the stances of those at both poles of a basic argument about climate change. Many climate activists insist that “the science is settled.” They fear that calling attention to what still could be learned will undermine the case that we already know enough to act. They may also be wary of politicians espousing “more research” as a way to postpone an effective policy response. At the other pole, those whose goal is to forestall action regularly argue that climate science is so politicized that it provides no guide at all; for them to urge a more ambitious program, they would need to concede that the climate science enterprise is redeemable.

A broadly supported climate science enterprise would prioritize the need to understand how soon very large negative impacts could afflict humanity. Much depends on the many feedbacks within the climate system, each of which can either amplify climate change (a positive feedback) or suppress it (a negative feedback). A positive feedback occurs when increases in atmospheric carbon dioxide warm the Arctic, leading the permafrost to disgorge more carbon dioxide that warms the Arctic further. Another positive feedback occurs if, on a warming planet, some low clouds start to fade away, and the extra sunlight reaching the earth’s surface removes more clouds. A negative feedback occurs when extra carbon dioxide in the atmosphere stimulates the growth of forests, which in order to grow must take carbon dioxide from the atmosphere. The future strengths of these and similar feedbacks dominate our uncertainty about the future climate.

A multifaceted climate science effort might “retire” some currently salient risks. We may learn that a particular positive feedback is nearly certain to remain small, but that another may well become debilitating. To be sure, deciding how much to weight the planet’s worst changes requires a prior effort to sort out the meanings of “worst.” This can be accomplished only by blending in the insights of the social sciences and the humanities. Many severe changes to the planet in physical terms can be made less costly by investments in resilience, communication, and governance. There is also a need to take into account who will suffer most. Middle-building to anticipate and prepare for extreme climate change requires all hands on deck.

At its most extreme, a positive feedback becomes a tipping point that produces radical changes in the entire climate system. (The unbearable noise produced by a microphone and a speaker when they get too close to each other is the result of a feedback that has crossed a tipping point.) My colleague, Steve Pacala, calls the positive feedbacks of the climate system “monsters behind the door.” It seems that no monsters are yet among us: climate feedbacks are operating nearly

as they have operated in the past and are not changing quickly. But what if one or more monsters escape? The late Martin Weitzman posed this question quantitatively within the context of cost-benefit analysis. He pointed out that although his fellow economists had long assumed that the average responses of our planet deserve nearly all the attention, plausible nasty behaviors of our planet could actually be paramount reasons for action.⁶

Imagine a counterfactual in which the global climate resembles the current climate, with overall warming, shrinking Arctic ice, and the other features that now alarm us, but climate science hardly exists. The atmospheric concentration of carbon dioxide has risen to today's level, but scientists have not discerned its key role. We are not in the counterfactual state because of some fortunate decisions in the history of science. In 1958, geochemist Charles David Keeling began measuring the atmospheric carbon dioxide concentration high up on the Mauna Loa volcano on the island of Hawaii. At that time, many scientists thought this was not a sensible idea, expecting the concentration to be patchy, reflecting variable wind patterns that would sometimes bring distant industrial emissions into the measuring instruments and sometimes not. Keeling and those who supported him guessed right, and the results were reliable. At about the same time, a few far-seeing scientists created new institutional capabilities to coordinate simultaneous studies of Earth from many places. The International Geophysical Year of 1957 – 1958 produced Antarctic ice cores that revealed the level of carbon dioxide in the atmosphere through eight ice ages. Keeling's Mauna Loa record and the Antarctic ice cores are cornerstones of the climate science edifice. Each is a great story, worthy of inclusion in new curricula at every education level, from elementary school through college.

In short, we are deeply in the debt of the climate scientists, a few thousand people. Without them, we would be flying blind.

Why do I feel so driven to call for a more ambitious climate science effort, as a primary response to the high societal risks from climate change? During my short period in theoretical physics, culminating in five years on the Yale Physics faculty, I saw the norms of science at their best: openness and welcoming, contention and resolution (the Big Bang versus continuous creation, for example), error correction, the winnowing of the central from minor issues by the artful back-of-the-envelope calculation, and deliberate strategies (like the double-blind experiment) that inhibit the self-confirmation bias that leads people to find what they want to find. Fundamentally, I believe that science is a privileged way of knowing, that science provides humanity's most reliable searchlight as we navigate troubled waters.

Accordingly, I find it portentous that participation in climate science is on the minds of so few scientists in neighboring disciplines. I can point to some wonderful exceptions, but I wish that a greater number of senior investigators in neigh-

boring fields were redirecting their research and urging their students to join them.

I conjecture that this distancing by scientists in neighboring disciplines can be attributed in part to their disinclination to give the benefit of the doubt to the findings of climate science that they read about in the popular press. I have heard such skepticism in countless conversations about climate science over the years with scientists and engineers in other fields, especially in physics. Much of this distancing, as best I can determine, is a response to the politicized messaging around climate science. Great distress spread through the American Physical Society (the professional society of American physicists), for instance, when one of the Society's public statements said that evidence for human-induced climate change was "incontrovertible." Many members were appalled. After all, no finding in science can be beyond controversy. The history of physics is replete with revisions of previous orthodoxies. The Society decided to revisit the statement, and "incontrovertible" was set aside.

A specific source of the scientists' misplaced skepticism is the widely promulgated claim that "97 percent of climate scientists" believe that currently observed climate change is at least partially human-induced.⁷ The statement is probably an underestimate. But if the goal is to persuade a scientist that some specific research community is conducting its work according to the norms of science, assertions that 97 percent of scientists in that community believe X (no matter what X is) are counterproductive. Science isn't about believing, and it isn't about voting; every good scientist leaves room for doubt. When a scientist in another field hears "97 percent," she worries whether this is a field seeking consensus rather than searching for disruptive insights; she worries, even, that there may be coercion. From my perch, I find that the norms of science are scrupulously practiced and well defended by climate scientists. Still, no other area of science is shackled by anything resembling 97 percent, as far as I know.

It is sobering to learn, however, that the "97 percent" argument has been singularly effective in persuading lay audiences that climate change science is well-grounded science, not up for grabs. It directly addresses the counterargument that there is no consensus at all among climate scientists, which has been the weapon of choice for interest groups seeking to undermine initiatives responsive to climate change. It is not surprising, therefore, that 97 percent is so prevalent. Evidently, the 97 percent argument is being heard entirely differently by public and professional audiences.

The second middle-building exercise I am advocating in this essay addresses the solutions to climate change. The two-sided reasoning in the Hippocratic Oath is with us again. The burden of proof is on those who would take an option off the list. However, there must be room not only to say yes

to a solution, but also to say *no*. A useful word is “conditionality”: the constraints policy-makers should impose when they facilitate the deployment of any solution. Another word used for these constraints is “guardrails.”

In evaluating solutions, engaged citizens like you and me need to be wary, but also to keep an open mind. Within a decade or two, there may be some exciting new technologies, and some countries may have adopted stringent emission-reduction policies (a very high carbon price or its equivalent) that transform energy and land-use competitions. On the other hand, some solution may have been introduced at too fast a pace, in the sense that it has induced a level of resistance that requires starting again.

The world has a portfolio of solutions, as Steve Pacala and I illustrated with an ecumenical analysis in 2004.⁸ The conversation about solutions is actually many parallel conversations, each focused on a single important pathway. Pacala and I called these low-carbon options “stabilization wedges,” conveying that they have the potential to grow steadily to reach a climate-significant scale from a small base. Quantitatively, a full wedge is a strategy that reduces the global carbon dioxide emissions rate fifty years from now, relative to what it otherwise would be, by the equivalent of 10 percent of the current emissions rate.

To keep this essay within a reasonable length, I discuss several of the wedges being taken seriously today, but by no means all of them. Not addressed are the many lifestyle choices made by the prosperous in all countries that affect climate, such as diet, travel, and the acquisition of possessions;⁹ I do discuss family size. I omit hydropower and geothermal energy, two important electricity supply wedges. I also do not consider hydrogen-related wedges. Suffice it to say that several strategies involving hydrogen (a carbon-free fluid) could become important, because hydrogen can be produced in many ways and can displace fossil fuels in many of their current roles in industry and transportation. Hydrogen competes with electricity and is disadvantaged in that competition because hydrogen requires a new energy infrastructure.

Every wedge offers opportunities for middle-building conversations. Below, for each wedge, I identify such conversations.

Energy efficiency and electrification. Sharp reductions in energy consumption are essential in a climate-responsive world. Fortunately, deep trends in technologies have long pointed toward lower energy use. New materials, new sensors, and new data-processing algorithms (in aggregate, “smart” technologies) are enabling a host of relatively risk-free technological and social innovations that fulfill human needs with minimal involvement of the beneficiary. To cite a single insufficiently celebrated example, the highly energy-efficient light-emitting diode (LED) is displacing most other lighting technology.

When it comes to reducing carbon dioxide emissions, energy efficiency is joined at the hip with the electrification of the economy. The reason is that the

use of oil and gas as fuels cannot be eliminated with energy efficiency alone. A two-step shuffle holds center stage: substitute electricity for the oil or gas, while in the same time period greatly reducing the carbon dioxide emissions associated with producing the electricity. Shifting from the gasoline-powered to the electric car is probably the best example of a wedge based on this two-step shuffle: the battery-powered vehicle is poised to transform transportation, but the carbon dioxide emissions from driving won't fall much, if at all, if the electricity charging the car's battery is produced from coal.

In the way, nonetheless, are societal inertia, misaligned economic incentives, and mistrust of innovation. An apt example is the challenge of overhauling the ways that buildings are designed and constructed. The unrealized opportunities are transnational: the many complexes of apartment buildings currently under construction in the expanding cities of the industrializing countries are locking in much unnecessary energy consumption by copying the suboptimal practices and policies that shaped comparable projects built decades ago in now industrialized countries: notably, the "first-cost bias" that ignores all costs incurred after occupancy. The obstacles are similar in transportation, heavy industry, agriculture, and other economic sectors. Middle-building conversation would focus on ways to accelerate the realization of energy-efficiency wedges, sector by sector.

A broad conversation would also encourage a search for ways to assure a balance between promoting low-carbon options and protecting individual liberty. The recent opposition to the elimination of most incandescent light bulbs from U.S. markets provided a taste of arguments that lie ahead, many of which will be more difficult to dismiss. Indeed, a similar pushback may emerge over policies designed to end all cooking with gas in favor of cooking with electricity. I worry about zealotry on the part of the proponents of energy efficiency. An apt quote is from John Maynard Keynes: "Madmen in authority who hear voices in the air are distilling their frenzy from an academic scribbler of a few years back." Any campaign to restrict the use of air conditioning or airplane travel, for example, will require careful listening, not frenzy.

Fewer people. The demographic transition (falling birthrates) has substantially reduced climate change over the past fifty years, and is expected to continue to do so. Parents exhibit a nearly universal preference for fewer children as they become wealthier, to such an extent that the populations in an increasing number of countries are already falling, and the global population may well head downward at midcentury. All else being equal, a smaller population brings with it the consumption of fewer resources, less crowding, and more room in the atmosphere for the emissions of future generations. However, a falling population can be unnerving and lead a government to bribe or coerce parents to have more children than they wish. Granted, the demographic transition creates a population that grows steadily older on average, a challenge already with us. And surely, populations can fall

too quickly. One task for the middle-builders is to examine transitions that align falling populations with social stability. For example, how might governments incentivize more of the healthy elderly to remain contributors to the economy?

Solar and wind power. The dramatic reductions in the costs of solar and wind power over the past two decades have created an expectation that they will be the workhorses of the future global energy system. Both are growing rapidly. Remarkably, the owner of a single solar panel providing refrigeration and cell-phone charging at her remote village hut is benefiting from the same feats of semiconductor science and manufacturing as the suburban household drawing power from a rooftop array or a million-panel facility in a distant desert. And platforms for wind turbines are marching offshore into steadily deeper water, much as platforms for oil and gas drilling did earlier.

Obstacles to expansion are appearing, however, as solar and wind power gain market share. The best solar sites aside from deserts are pristine south-facing hill-sides (in the Northern Hemisphere), the best onshore wind sites are ridges, and the best offshore wind sites are within view of coastal communities – assuring resistance to intrusions on landscapes and seascapes and counter-pressures to preserve the wilderness experience. Similar siting conflicts may thwart the march of high-voltage power lines across hundreds of miles of countryside to connect these remote locations to major population centers (replacing the transport of the chemical energy in coal, oil, and natural gas by rail and ship and pipeline). Greater compensation for affected communities will reduce hostility in some situations. It is highly probable, however, that location-related concerns will diminish the competitiveness of wind and solar power, as they do other energy sources. Middle-building conversations would get out ahead of these place-based controversies.

Wind and solar power, unlike most other energy sources, are not at our beck and call. Shortfalls measured in seconds and hours can be accommodated with the help of batteries. But shortfalls measured in week-long stretches of wind lulls or cloudiness (or both) will require responses that come, at least partially, from the users of electricity. Especially interesting and fraught, consumers may be asked to forego the luxury of instant gratification of their demand for electricity no matter what the cloudiness and windiness outdoors. A more supple energy system may evolve that promotes behavioral accommodation (washing clothes only on sunny days and drying them outdoors, for example, as was the norm in my childhood). Although technological strategies to store electricity or heat for long periods of time are available in many locations, the ultimate contributions of wind and solar electricity will be much larger if consumers tolerate – even welcome – weather-driven modifications of their behavior. Adapting to intermittency is a good topic for middle-building.

Capture of carbon dioxide from fossil fuel power plants and other industrial facilities. An important low-carbon strategy is to keep out of the atmosphere the carbon diox-

ide produced during the combustion of coal, or oil, or natural gas at (eventually) every centralized facility where these fuels are burned.¹⁰ In this process, the carbon dioxide is extracted from the exhaust-gas mixture heading for the chimney, before it reaches the air outside. Then, the carbon dioxide is piped into a geological formation deep underground where it can be stored at least for centuries. (An alternative to burying the carbon dioxide is to make a durable material out of it.) To contribute a wedge, a new below-ground industry would need to become comparable in scale to the current oil and gas industries. Emergent problems include the risk of triggering an earthquake during carbon dioxide injection, which seems already to be slowing deployment in Japan. There is also the potential, in poorly characterized storage sites, for upward leakage of carbon dioxide into ground water. These problems are not insurmountable.

The political implications of so-called “carbon dioxide capture, storage, and use” are intriguing. This wedge enables the fossil fuel industries to contribute solutions to climate change and enlarges the potential pro-mitigation coalition. It makes the winding down of the fossil fuel era a less precarious undertaking by creating new assignments, still consistent with strong climate goals, for the current entrenched labor force producing and distributing gas, oil, and coal, and it allows a repurposing of much of the existing infrastructure.

This wedge has few fans, however, and not because it has proven to be infeasible. Indeed, a modest carbon dioxide pipeline infrastructure already exists, and promising variants of the key technologies are arriving. Yet the coal, oil, and natural gas industries provide lackluster support, unpersuaded that governments will sustain the necessary incentives. At the same time, many activist environmental organizations oppose the strategy. Some argue that, on the basis of current practices in the fossil fuel industries, one should expect regulatory capture and lack of transparency. Others go further, arguably motivated as much by ending the fossil fuel era as by slowing down climate change. They rightly see this wedge providing an escape route for fossil fuel in a “decarbonized” world, and they simply do not want this option to succeed. Sorting out the merits and demerits of carbon dioxide capture, storage, and use is yet another promising middle-building exercise.

Direct capture of carbon dioxide from the air. Carbon dioxide can be removed directly from the air with chemicals, just as it can be removed from industrial effluent (the low-carbon wedge just discussed). However, only one in twenty-five hundred molecules in the air is carbon dioxide, as compared, for example, with one in about twenty-five molecules in the exhaust gas at a natural gas power plant. As a result, the capture technologies are very different, and far more hardware is required to capture the same amount of carbon dioxide from the air than from flue gas. But the steps subsequent to capture are exactly the same: the carbon dioxide must then be either stored or used. This low-carbon option is called “direct air capture.”

Direct air capture is a “negative-carbon” strategy, meaning that it reduces the amount of carbon dioxide in the atmosphere. Several decades from now, direct air capture and other negative-carbon strategies may be deployed at such a large scale that they drive the carbon dioxide concentration of the atmosphere downward. For the next few decades, however, this wedge will be hampered by the large amounts of energy required to drive its associated mechanical and thermal equipment. In many locations today, the quantity of carbon dioxide emitted into the atmosphere in conjunction with running an air-capture facility would be comparable to the quantity of carbon dioxide that the facility extracts. The argument for building direct air capture projects now, while the world’s energy system is only slightly decarbonized, is to gain experience and buy down the costs.

Negative-carbon strategies offer ways to cancel the most recalcitrant emissions, like those from airplane jet fuel. Corporations are already offering products with “net-zero” carbon dioxide emissions by tying a product to a negative-carbon project and asserting that the emissions associated with making and using the product are “offset” by atmospheric carbon dioxide removal. Large companies and start-ups are already teaming up to conduct the first negative-carbon demonstrations. Extensive use of third-party verification and the resolution of a host of nettlesome accounting issues will be required for carbon offset markets to flourish at a climate-significant scale. Middle-building can create the consensus required to formulate the rules of the road.

In my opinion, neither energy efficiency, nor solar power, nor wind power, nor fossil energy use accompanied by carbon dioxide capture, nor direct removal of carbon dioxide from the atmosphere has a downside as ominous as three further climate-driven energy strategies that conclude this section: nuclear power, bio-carbon, and solar geoengineering.

Nuclear power. Fifty years ago, I believed that the case for deploying nuclear energy instead of fossil fuels would prove to be so compelling that it would lead to a broad disavowal of nuclear weapons by the world’s nations, a durable taboo on their use, and steady progress toward nuclear disarmament. Rather, the opposite has happened. Nuclear weapons are desired by more countries today than fifty years ago and even a decade ago. The global nuclear power wedge is perilous because national nuclear power programs provide cover for nuclear weapons development and make nuclear war more likely.

Conditionality in this instance means forestalling any major expansion of global nuclear power until such time as there are global institutions that manage the nuclear fuel cycle so well that there is no ancillary promotion of nuclear weapons. This probably necessitates the international ownership of all uranium enrichment and nuclear fuel reprocessing wherever either is pursued, as advocated by Mohamed ElBaradei when he was director general of the United Nations International Atomic Energy Agency.¹¹ It also requires serious progress in delegit-

imizing nuclear weapons, and the retention in each successive generation of the understanding of just how horrible nuclear war is.

In an essay in the Fall 2009 issue of *Dædalus* “On the Global Nuclear Future,” my nuclear scientist colleague Alex Glaser and I struggled with the merits of global nuclear power as a route to reduced climate change. After conceding that “the upper limits of climate change are terrifying, amounting to a loss of control of the climate system as positive feedbacks of various kinds set in,” we nonetheless “judge the hazard of aggressively pursuing a global expansion of nuclear power today to be worse.”¹² Alex and I still agree with what we wrote then.

Middle-building exercises would address not only connections to nuclear weapons, but also the escape of radioactivity from nuclear facilities. The latter could result either from an accident in peacetime, or from a terrorist attack, or from being targeted in a war. From the 1986 accident at Chernobyl in the then Soviet Union (documented brilliantly in the recent book *Midnight in Chernobyl*) and the 2011 accident in Fukushima, Japan, one may infer that the regulatory process is so prone to capture by the nuclear industry that major releases of radioactivity cannot be excluded.¹³ Moreover, a nuclear power plant accident has a distinctive feature, evident in the responses to those two disasters, which is contagion: an accident at any nuclear plant creates strong pressure to shut down every other nuclear plant.

Biocarbon. There is several times as much carbon in the earth’s forests and grasslands and soils (“biocarbon”) as in the atmosphere (where nearly all of it is in carbon dioxide). In the course of a year, plants use photosynthesis to take carbon from the atmosphere in the growing season and return carbon to the atmosphere as they decay; in most places these two flows approximately balance out. Currently, there is considerable interest in biological wedges that shift that balance slightly, moving some atmospheric carbon into vegetation.

Planting a new forest is one way to accomplish the transfer. What needs to be taken into account so that this specific undertaking does not go awry? Consider, for example, that you are a forester working in a country that is heavily subsidizing the removal of carbon dioxide from the atmosphere. Your boss buys an extensive land parcel and puts you in charge of planting a new forest there; she tells you that storing as much carbon as possible on the land is your only objective. What do you do? Establish a monocrop? Pour on fertilizer? Be inventive.

Now, change roles. You are a policy-maker in that same world, designing a market that is rewarding carbon removal, and you are motivated by broad social and environmental goals. What conditionalities do you insert into the carbon market in the interest of eliciting the land use and forestry you welcome and deterring outcomes you decry? You could prohibit using land now in agriculture, so as not to restrict the food supply. You could require the biodiversity value of the land to be taken into account, as well as the forest’s effect on local water, and whether there are forest dwellers nearby whose lives will be disrupted. The subsi-

dy could be only for “net carbon,” where the carbon dioxide emissions associated with chainsaws and trucks are subtracted from the carbon stored. If the forest is to be actively managed for timber, you could credit not only the carbon in the forest but also the carbon from that forest stored in the beams and trusses of buildings that may stay in place for a hundred years.

This vignette gives a glimpse of the complexity of biocarbon solutions. The story is similar if ethanol for vehicle fuel is produced from corn or sugarcane, displacing gasoline. Or if crop and forest “wastes” are processed at bio-refineries to produce climate-friendly chemicals.

A particularly interesting variant, biological energy with carbon dioxide capture and storage, is another negative-carbon strategy, like direct air capture. Photosynthesis transfers carbon from the air into a living plant, which is then harvested and burned to generate electricity. If chemicals capture most of the carbon dioxide in the exhaust of this biomass-fueled power plant, and this carbon dioxide is then stored for the long term, the net result is to reduce the amount of carbon dioxide in the atmosphere.

At the global level, mitigating climate change primarily through manipulations of the biosphere requires the use of a significant fraction of the earth’s land. The underlying reason is that photosynthesis is an extremely inefficient process for converting sunlight into energy. Consequences for global food production and biodiversity can be devastating without careful planning. In contrast to some of the other options just discussed, extensive conversations about opportunities and threats related to most biocarbon wedges are already underway.

Solar geoengineering. If we human beings can now modify our planet inadvertently by pursuing everyday activities, it should not be surprising that we also now have the capability to manipulate the planet deliberately with targeted measures: to “geoengineer.” In particular, we have the capability to reduce incoming sunlight to compensate, at least partially, for our current warming of the planet. One scheme increases the reflection of incoming sunlight by modifying the upper atmosphere (the stratosphere). A closely related concept makes the tops of clouds brighter.

The immediate decisions today are about small-scale field research. Many advocate prohibition. They doubt that human beings will ever use tools wisely that can manipulate the whole planet; in particular, they see no plausible route to global governance. Some of these critics see a slippery slope where small-scale experiments with no lasting impact lead to some much larger experiment that creates the very disaster it was meant only to learn about. They are opposed by others who, in support of field experiments, insist on the need to be prepared; the earth could soon reveal itself to be at the upper end of sensitivity to human perturbations, and it is therefore incumbent on the research community to move promptly to develop the means to counter the adverse changes. Geoengineering might be able to retard sea level rise, for example.

Disquieted by how poorly we understand our planet, I see the cart in front of the horse here. The systems that are candidates for manipulation through geoengineering (the stratosphere, clouds, and several others) are the same as the systems requiring deeper understanding to fathom the risks of human-induced climate change in the absence of geoengineering. A prudent research plan would give priority to how our planet works now, and it would treat whatever benefits accrue to geoengineering as subordinate. Inevitably, much of the new knowledge of the earth that will be acquired in the near future will be “dual use,” a phrase invoked in the sphere of national defense to describe technology with military and nonmilitary applications. This commonality between arms control and geoengineering alerts us to the need to guard against risk assessments of geoengineering that are bloodless and feature excessive quantification.

I expect that the mission of solar geoengineering will expand beyond planetary-scale cancelation of global warming to include objectives bearing on human comfort and convenience at much smaller scale, and I fear the consequences for other species. How will they fare if we humans use solar geoengineering to remove hurricanes and heat waves and droughts? Countless species occupy ecological niches that depend upon climate extremes: the plant that flowers only during hot spells or that thrives in a flash flood, for example. Many of these niches will disappear, possibly to our long-term detriment, if we are not able to resist making the crooked straight and the rough places plain.

Conversations about geoengineering are likely to be the most contentious of all those I have proposed. Geoengineering engages profound feelings about human destiny. It requires us to ask what level of control of the planet human beings ought ever to have.

The risks of solutions were not considered in the global diplomatic process leading to the Paris Agreement negotiated in 2015, which identifies the world’s goals for climate change management. Only the risks of climate damage were motivating. Implicitly, the diplomats were expressing their confidence that the science and engineering community is clever enough to get us there safely.

The overarching Paris goal is simple to understand. Referencing the average surface temperature of the planet, it affirms the desirability of constraining future activity so that this temperature never rises even as much as 2 degrees Celsius (3.6 degrees Fahrenheit) above its value in “pre-industrial” times (a period of several centuries ending around 1800, during which this temperature was roughly constant). Simplifying, the Paris goal requires the average surface temperature to stay “well below” – language used in the agreement – 16 degrees Celsius (about 61 degrees Fahrenheit), because the pre-industrial average surface temperature was about 14 degrees Celsius (about 57 degrees Fahrenheit). The temperature rise thus far has taken us about halfway: the average surface temperature has risen close to 1 degree Celsius.

The nearly universal acceptance of the “two-degrees” goal is a triumph of diplomacy. Worldwide, it has spawned countless supportive quantitative commitments and placed palpable pressure on corporations and governments to begin the required rapid transformations of technological infrastructure and land use. The two-degrees goal is a social construct, however, not a scientific finding. Science has not identified any line in the sand, a boundary between safe and unsafe. We do know that climate change gets steadily more dangerous as the earth warms. But as far as anyone knows now, 2 degrees Celsius is not a tipping point. As best I can tell, even the affirmatively risk-driven global climate science program I have advocated is not likely to pin down tipping points, even though it will improve our understanding of the earth’s many feedbacks. Our planet is just too complicated.

The world may go past the two-degrees target. In already industrialized countries, the target requires overhauling entrenched institutions and replacing infrastructure long in place. In industrializing countries, the target requires severe departures from historical patterns of development (leapfrogging). The world is not yet prioritizing either of these challenges. Indeed, the industrialization ahead in Asia and Africa is a good candidate for another middle-building exercise. In what proportion, for example, will India build coal power and solar power, and what are the critical determinants of that fateful and imminent choice inside and outside the country? So far, conversations about such urgent questions are rare.

A world unprepared for exceeding the two-degrees target could succumb to panic and defeatism. Panic could lead to an uncritical embrace of dangerous solutions. Defeatism could bring a cessation of effort, even though at no future time will inattention to climate objectives be preferable to continued concerted action. Three degrees of warming is immensely safer than five degrees (Celsius! A Celsius degree is 1.8 Fahrenheit degrees, and five Fahrenheit degrees of average surface warming is immensely safer than nine degrees). We need to prepare a soft landing for “two degrees,” in case we turn out to need it.

Is witnessing for the middle an oxymoron? Isn’t it just a way of playing safe? Can witnessing for the middle ever move the needle more quickly and less reversibly than witnessing for an extreme? If witnessing for the middle can reconfigure the debates, clarify the stakes, reduce hype, and create effective coalitions, then yes it can. I have provided two examples of activities that can contribute to these objectives, both focused on the risks of worst outcomes: in one case, the risks inherent in our not being able to rule out a very unstable planet, and in the other case, the risks of misapplied solutions. In essence, I am advocating for opening two new conversations.

What conditionalities ought to be placed on middle-building itself? Some will doubtless argue that the all-encompassing global climate crisis is so grave that uncompromising extremism is justified: it is appropriate to present the immediacy

of the crisis and the goodness of solutions without qualifications. This position will remind some readers of what Barry Goldwater said in his 1964 presidential nomination acceptance speech at the Republican National Convention: “extremism in the defense of liberty is no vice.” What about that sentence was so upsetting at that time? Is it less menacing today? Granted, nuance can diminish the commitment to action. But surely, in dealing with a threat that, however dire, will likely remain ill-defined for a long while, it is essential to build a resilient climate change discourse by telling the story straight.

The story is about the collective destiny of humankind on our planet, which is a quite new concern. Here is how I would tell the story so far, in four paragraphs.

The planet we inhabit is so small that we are able to change it inadvertently with everyday activity. Humanity is only just beginning to scope the dramatic revisions of current practices that must be pursued on a planetary scale over many decades in order to sustain our collective well-being and the well-being of Earth’s other species. The implications are particularly severe for the many nations that have most of their industrialization ahead of them; as best we know, the planet cannot stay safe unless they follow novel development paths. Simultaneously, the already industrialized countries will need to overhaul their own infrastructures.

Climate science already provides an ample foundation for prompt action that slows the arrival of climate change. Nonetheless, climate science is incomplete. Climate scientists are gradually clarifying how the planet works, helped by the earth itself, which is gradually revealing its secrets. There is ample justification not only for much more ambitious climate science but also for greater focus within climate science on investigating best and worst outcomes, especially worst outcomes. Global climate change requires sustained risk management, which in turn requires ever bolder climate science.

Workable solutions are either at hand or in view. But every solution that mitigates climate change can be dangerous, if deployed inattentively at large scale. Every solution is a strong drug, with known and unknown side effects. Accordingly, we must resist any framing that contends that, in climate change, humanity faces a single overriding problem and that we must throw caution to the winds to solve it, subordinating all other objectives. No matter what the proposed solution, we must investigate every feature that might lead us to reject it. People intuit that solutions poorly applied could have unappealing consequences for getting and spending and bucket lists, for family size, for equity, for international security, for environmental soundness. Vigilance is the name of the game.

The human predicament is universal. All of us alive today, like it or not, are in the same boat. We share an obligation to protect the earth in order to protect ourselves and to sustain future generations. It requires an act of faith to believe that the voyage that lies ahead will be enjoyable, bringing new technologies strikingly superior to those we have now and greater well-being. The odds are better, however,

if we pursue the kinds of middle-building that reveal our common risks. I find hope in the possibility that confronting climate change collectively will gradually create a global identity that transcends our rampant tribalism.

The story has just begun.

AUTHOR'S NOTE

Dedicated to Robert Jay Lifton, a hero of mine, who is also contributing to this volume. Half a century ago, I joined him in organizing a campus-wide event at Yale called A Day of Reflection, which started fresh conversations about how scientists should relate to the military.

An early version of this essay was presented at the Witnessing Professionals and Climate Change Workshop held at Princeton University on May 12, 2018. I wish to thank Melissa Lane and Nancy Rosenblum for inventing the conference and for inviting me to give a talk there. I further thank Nancy for inviting me to write this essay and for commenting trenchantly on early drafts.

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All opinions and outright mistakes are mine alone.

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The Professional Ethics of Witnessing Professionals

Dennis F. Thompson

Professionals have an ethical obligation to bear witness to climate change. They should report, warn, criticize, and lobby to bring attention to the existential threat that climate change poses. But they also have an obligation to respect the knowledge that is the basis of their authority to witness. Witnessing carries risks to this professional authority. Witnessing professionals should avoid letting bias distort their advocacy, simplifying their statements excessively, overplaying the consensus in the field, neglecting their own conflicts of interest, and claiming authority beyond their areas of expertise. To witness ethically, the professional should advocate responsibly.

“**W**hat you have to say needs to be heard. . . . Are you willing to be a witness?”¹ Rafe Pomerance, director of Friends of the Earth, put the question to James Hansen, a prominent physicist turned climate scientist whose research on global warming pointed to the dangers of rising sea levels and other environmental changes with potential for catastrophic harm to the planet. Hansen had earlier concluded that carbon dioxide in the atmosphere would lead to warming sooner than previously predicted. As a scientist working at the Goddard Institute for Space Studies, he had tried to stay focused on his research and wrote mainly for his scientific colleagues. But then, recognizing that politicians, the public, and even many other scientists did not appreciate the seriousness of global warming, he accepted the challenge of the question that Pomerance put to him.² He became a witnessing professional. His testimony to Congress in 1988 dramatically put global warming on the public agenda. His subsequent advocacy furthered the cause, helping to make “the greenhouse effect” a familiar term in the public discourse.

Hansen’s witnessing was widely praised but not all of his efforts were welcomed. The government agency he worked for censored his remarks, and he ultimately left government service. Later, he became an advocate for nuclear power as an alternative to environmentally harmful fossil fuels.³ In the process, he provoked the ire of many of his former allies in the climate change movement, some of whom believed he was proposing a cure that was worse than the disease.⁴ He

appeared to be going beyond his own area of expertise and pronouncing on subjects on which he had no special authority to speak.

Hansen's career exhibits to a high degree the ideal of witnessing, a professional obligation that he admirably exemplified. But it also reveals one of the risks of witnessing, the temptation to speak beyond one's professional authority. It exposes a particular aspect of the general tension between the obligation to witness and the obligation to respect the knowledge that is the basis of professional authority.

I argue that professional ethics should include an obligation to witness: to speak and act publicly to call attention to existential threats to the society and the planet.⁵ But I also want to emphasize that this obligation poses challenges, not simply personal ones such as risks to a career, but also professional ones, such as risks of misrepresenting the knowledge that gives the professional the authority to speak. As professional ethics is broadened to include witnessing, this internal conflict becomes more acute.

Professional ethics only recently and still fitfully accommodates this broader notion of an obligation to witness. When we started the university-wide ethics center at Harvard more than thirty years ago, one of our aims was to strengthen teaching and research on ethics in the professions. Professional ethics was not prominent in the professions, at least not the kind of ethics that required serious theoretical and intellectual reflection, and even less ethics that included the obligation to bear witness.

That began to change, not mainly because of our efforts, I admit, but largely because of a wave of scandals that plagued many of the professions and business. Our own center was located in a building named for Alfred A. Taubman, who went to prison for price fixing in the auction business. Ethics courses began to be required in many law, medical, and business schools. Professional associations took notice. Applied ethics journals sprang up. Degree programs appeared. The ethics movement gained momentum not only among lawyers and doctors but also in the training of police officers, veterinarians, accountants, even economists. I was surprised myself just how far this movement has spread. Like many who teach ethics, I receive many textbooks in the mail. So when I received a book called *Undertaking Ethics*, I thought at first the title referred to "undertaking" as in "to begin" or "take on."⁶ But it turned out really to be about undertakers and the ethical dilemmas they face. Professional ethics now goes from cradle to grave.

This growing interest in professional ethics tended to emphasize only one aspect of the ideal of service that characterizes the professions. The primary subject of the service was still the patient, the client, the shareholder, the research community, and the cadaver. There was less attention to the other aspect of the service ideal: the responsibility to the public or society more generally. Professional ethics has begun to attend to the obligations that professionals have to bring their expertise to bear on issues of public welfare. It is increasingly rec-

ognized that they owe more to society generally, not only to the particular individuals they serve. Even undertakers ought to show some consideration for the environment.

Professionals can engage in the climate debate just like any citizen. They can step out of their professional role and speak as a concerned member of the public. But the professional's obligation to witness is different from and stronger than the obligation that they may have as a citizen. Professionals have special expert knowledge, hold positions of potential influence, and enjoy the privileges granted by society to their profession. These three characteristics of professionals together create an obligation to contribute more to preventing social harms than is usually expected of an ordinary citizen.

The obligation does not extend to all social harms. Because professionals have other obligations – notably to their clients, patients, colleagues, and students – their time for satisfying the demands of the service to the public is limited. It is a scarce resource and should be deployed for compelling reasons. Climate change understood as an existential threat surely qualifies as such a reason.

The strength of the obligation to bear witness varies in proportion to the knowledge and the influence the professional possesses. The more the professional knows or should know, and the more potential influence the professional has, the greater the obligation. Also, the obligation is stronger to the extent that the threat is being ignored or neglected by leaders (such as politicians and corporate executives) who are in a position to bear witness but fail to do so. The obligation applies in the first instance to some climate scientists, who are the examples commonly used in discussing witnessing. But it sometimes applies even more to other professionals such as lawyers and judges. Judges, for example, do not have to become climate activists, but they should at least be willing to acknowledge the threat and accept the obligation to learn more about it. They should not act with indifference as Justice Antonin Scalia did when he was corrected for confusing the troposphere with the stratosphere. “Troposphere. Whatever. I told you before I’m not a scientist. . . . That’s why I don’t want to have to deal with global warming, to tell you the truth.”⁷

Medical professionals are in a position to call attention to the effects of climate change on public health. Journalists, too, have a role. They have a responsibility to avoid false equivalence in their reporting on climate deniers and climate activists. Then there are the meteorologists on TV, who, though they are in a position to bear witness before wide audiences, have been among the professionals most reluctant to acknowledge the threat of climate change. Less than half of all U.S. broadcast meteorologists believe that human activity is the primary cause of climate change over the past fifty years, and only 12 percent or fewer are very comfortable with presenting information about global climate impacts, mitigation strategies, or future global climate projections.⁸

There are many ways to bear witness. I mention four – all forms of advocacy – in order of increasing activism. First, reporting: the professional simply but persistently affirms the findings of climate science for the benefit of those who may not have paid attention. Second, warning: the professional emphasizes the dire consequences that climate change is likely to bring if action is not taken. This is what Naomi Oreskes calls the role of “sentinel.”⁹ Third, criticizing: the professional directly confronts the climate deniers and corporate interests that stand in the way of countering global warming. Fourth, lobbying: the professional argues for particular policies such as a carbon tax or reduction in coal production; or more general and less controversial goals such as greater funding for research and more accurate accounting of the costs of climate change.

There are also many possible audiences for witnessing. The general public is the audience most often assumed by proponents of witnessing. But witnessing can take place in small groups, professional associations, educational institutions, and a wide variety of other settings. (I use “public forum” to refer to all of these sites.) Witnessing can take the form of statements, testimony, reports, petitions, media appearances, social media posts, podcasts, and other modes of communication. Witnessing can be solitary, but more often it is collective, as professionals join with others to report, warn, criticize, and lobby.

Attempting to fulfill the obligation to witness is not easy. The reason is not simply the practical limitations of time, resources, or the prospect of political pressure. The reason I emphasize here is that service to the public may conflict with the obligation to respect the body of knowledge that gives a professional the authority to speak in the first place. Broadening the obligation to require professionals to bear witness (which includes speaking persuasively to a wider public) creates a tension with the obligation to present their expert knowledge responsibly (which is the essence of professing). Professionals who dare to enter the public debate on climate change may face a conflict between witnessing and professing. The needs of public communication are not always compatible with the obligations of professional authority.

This potential conflict poses five distinct challenges. The witnessing professional must be able to communicate without exhibiting undue bias, excessive simplification, improper dependence, overplayed consensus, or misplaced expertise. In each case, these vices result from carrying the legitimate demands of witnessing too far, failing to find an equilibrium between witnessing and professing. The aim should be to witness responsibly: to serve society and respect professional authority at the same time.

In *opposite advocacy*. To be an effective witness in the public forum, a professional may have to act more like an advocate than like an “honest broker.”¹⁰ As an advocate (even when reporting), the professional may have to em-

phasize one side more than another in the debate – for example, the dangers of climate change more than the uncertainties about its extent. The challenge is to engage with this degree of advocacy, but to avoid bias that would distort professional knowledge. Witnessing professionals must maintain the distinction between emphasizing some facts rather than others (acceptable advocacy), and making sure that the facts that are emphasized are not reported inaccurately (in-opposite advocacy). Professionals need not tell the whole truth (as they would seek to do in scholarly writings), but they must affirm nothing but the truth. This distinction between the selection of facts and the presentation of facts is not always easy to maintain. Facts do not stand alone, but require interpretation, and may involve reference to other facts that the advocate might prefer to slight. Facts that bear on the strength of the claims one is making should not be omitted. The challenge of maintaining this distinction is illustrated by the controversy over a blog post by Roger Pielke, a prominent contributor to the climate debate who recommends that scientists assume the role of honest broker rather than act as an advocate.¹¹ As part of the inaugural edition of Nate Silver’s *FiveThirtyEight* site, Pielke argued that weather disasters are not mainly caused by climate change. He presumably thought he was acting as an honest broker, providing balance to what he saw as the exaggerated claims of other scientists. Even if his factual claims were true – and critics challenged them¹² – his post was seen as supporting climate deniers. (Some critics question whether he has been an honest broker in other instances as well.)¹³ In any case, adopting the role of honest broker is not sufficient if the aim is to alert the public to the dangers of climate change. Witnessing professionals would do better to emphasize instead the long-term harms rather than getting involved in controversies about the causes of particular weather disasters.

If professionals are to be advocates, what should they be advocating for? The role is protean. Sometimes it implies advocacy simply for more research on climate change, as Robert Socolow proposes.¹⁴ This goal is worthwhile provided it is not used as an excuse to avoid undertaking more active measures. Sometimes the role includes a more controversial form of advocacy, recommending policies such as carbon caps or methods of geoengineering interventions or even nuclear power. The risk of bias becomes greater here, as the professional may find it harder to avoid becoming embroiled in partisan battles. (Also, the temptation is greater to make claims that go beyond one’s professional competence, as I discuss below.)

If this kind of advocacy is thought to compromise professionals’ standing as impartial authorities, they may choose a more general kind that stands a better chance of avoiding narrowly partisan politics. Environmental ethics scholar Dale Jamieson, for example, advocates for seven priorities, most of which could be accepted by a wide range of climate activists whatever their partisan affiliation.¹⁵ They include such general aims as integrating adaptation strategies with development plans, adopting and diffusing technologies that are already “on the shelf,”

and instituting full-cost energy accounting. Witnessing professionals addressing climate change cannot (and should not) completely avoid political controversy, but even when they advocate, they do not have to identify with a particular political party or special interest group.

One of the most appropriate approaches for the witnessing professional would be to adopt the role of Oreskes's sentinel. The professional would accept the responsibility of alerting the public, in no uncertain terms, to the impending disasters that climate change is bringing. This role does not abandon the commitment to facts, but presents them in a way to call attention to the threat. The sentinel does more than advocate for more research but less than lobby for particular policies (though some activists may of course seek to be lobbyists as well as sentinels). Even as the witnessing professionals scrupulously respect the facts they use and seek to remain neutral on policies they might mention, they do not have to allow the uncertainties that are inevitable in climate science to weaken the forcefulness with which their warnings are presented.

E*xcessive simplification.* The expertise the professional brings to the public forum is not easily conveyed to a general audience. Some simplification is necessary, but it can go too far. It is a "massive oversimplification" to reduce "the complexity of climate change . . . into the sound bite of 'climate change means more extreme weather.'"¹⁶ This not only misrepresents the "true state of science" but also risks discrediting valid claims about the effects of climate change. Not all simplifications are to be avoided, even when they are inexact. F. Sherwood Rowland in 1974 used the phrase "hole in the ozone layer" to describe the thinning of ozone in high latitudes.¹⁷ (The thinning is the result of the chemical action of chlorofluorocarbons, and it increases ultraviolet light at ground level, giving rise to an increased risk of skin cancer, among other harmful effects.) The term quickly became a catch phrase. But technically, there is no hole and no layer. Scientific journals at first resisted the phrase but even they eventually came to accept it. The phrase describes a real problem in vividly accessible terms, and while not literally true, it is not practically misleading. It does not carry any implications for policy that differ from those of an unsimplified picture of the depletion of ozone. Refusing to simplify when it is appropriate as in this case is to risk being overly punctilious, the opposite vice of excessive simplification.

How can witnessing professionals make their case without distorting the complexity of their knowledge? Some professionals are more adept than others in translating the science into messages that are accessible to a wider public. Division of labor may be necessary. Professionals who are more comfortable in the public sphere can work with their more cloistered colleagues to shape a message that can be more accessible. It is important also to remember that there is not a single audience. There are other scientists not specializing in climate science and

even informed policy analysts who can follow technical discussions and help translate the findings into language that journalists and commentators can follow. The journalists and commentators can then prepare messages that are more readily comprehensible. The process of communication is distorted if we think of the witness as a lone climate scientist who has to bear witness all on his or her own.

The risk remains that in this translation process, the science will be simplified excessively. It may be sensationalized in one direction or minimized in the other. The best protection against this risk is to be found in the reactions of scientists themselves. They are witness not only to climate change but also witnesses to how the information is conveyed to the general public. Even the scientist who is not adept at public communication may be in the position to call out distortions and simplifications as they reach the end of the communication chain. This kind of feedback loop already exists to some extent, but it should be explicitly recognized and further reinforced.

O *verplayed consensus.* To support their claims in the public forum, witnessing professionals are inclined to appeal to the authority of professional opinion. This is perfectly legitimate since they speak not for themselves but for a body of knowledge that partly defines their profession. However, under pressure, some may be tempted to exaggerate the degree of consensus that exists in the profession. They may be inclined to downplay, for example, genuine differences that exist in the estimates of the rate at which global warming is occurring. The more controversial the professional opinion, the more professionals feel the need to enlist the support of fellow professionals, and the greater the temptation to overplay the degree of consensus. The risk is real, though there is no evidence that exaggeration is widespread among climate scientists themselves.

There may be a problem even when the consensus is strong. On climate change, nearly all experts agree that global warming is real, and most agree that humans are a principal cause. But when an activist asserts that 97 percent of climate scientists agree about the cause of global warming, some scientists may recoil.¹⁸ Socolow argues that overplaying consensus can mischaracterize the way science proceeds; it neglects the role of scientific dissent in challenging conventional views by bringing forward new evidence and new theories. As he writes:

If the goal is to persuade a scientist that some specific research community is conducting its work according to the norms of science, assertions that 97 percent of scientists in that community believe X (no matter what X is) are counterproductive. . . . When a scientist in another field hears “97 percent,” she worries whether this is a field seeking consensus rather than searching for disruptive insights.¹⁹

Overplaying consensus may risk alienating some scientists, but the aim is not only or mainly to raise the status of climate science within science. Scientists are

only one audience. Claims of consensus (when well founded) are less likely to be counterproductive with journalists and the general public.

The witnessing professional has to find the balance between appealing to consensus and respecting the skeptical ethos of the scientific enterprise. In seeking that balance, the professional should clearly identify degrees of consensus, and differentiate issues on which there is agreement approaching consensus from those on which there is not. The professional should acknowledge that any consensus that might exist on broader questions of climate change breaks down as soon as the discussion turns to policy: what exactly should be done, and who should do it? But even when most climate scientists agree, professionals should not overplay the consensus card. They should make clear that “science . . . isn’t about voting” and that “every good scientist leaves room for doubt.”²⁰ An early influential paper documenting the scientific consensus on climate change proceeds in this spirit and strikes the balance that witnessing professionals should strive for.²¹

On some of the claims that the professional wishes to make, consensus is not to be found. There is no consensus on what counts as a “climate emergency,”²² but that should not stop the professional from arguing for the claim that we are facing a crisis of that magnitude. If consensus is treated as the only or main basis of professional authority, the scope for witnessing is drastically reduced. Professionals should be prepared to bear witness in a realm of plausibility, in which the standard is sufficient agreement rather than complete consensus.

I*mproper dependence.* Professionals can often be more effective if they work with officials in government and corporations. They need funds to support their research, and sometimes funds to publicize their findings. But if they get too close, they risk sacrificing their independence. They end up serving special interests rather than the public interest. The risk is well known in the case of funding from industry, though it is climate deniers who are more likely to receive such support.²³ But the motives of professionals have been questioned even when their support comes from the government. A Heritage Foundation critic remarked: “A lot of people are getting really, really rich off of the climate change industry. . . . The tidal wave of funding does reveal a powerful financial motive for scientists to conclude that the apocalypse is upon us.”²⁴

The witnessing professional may not be able to respond directly to this kind of cynicism about their motives. The best answer is to defend one’s conclusions on the merits in the public forum. But the ever-present doubts about motives underscore the need for rigorous conflict of interest policies. These are familiar enough in research funding, but that they are needed in witnessing is not so widely recognized. Like the research scientist, the witnessing professional should take steps to avoid conflicts of interest, or at least disclose conflicts if avoidance is not feasible. The aim is not so much to prevent professionals from shading their conclu-

sions to please their industry or government sponsors (which may happen) but to reduce the chances that they will appear to be influenced by their sponsors even when they are not. The purpose of conflict of interest policies is to maintain public confidence. The policies are intended to give the public, most of whom cannot personally know the professionals, some assurance that they are not being unduly influenced. Disclosure of funding sources, affiliations with interest groups, and professional background would be a worthwhile first step toward transparency.

Misplaced expertise. Professionals are typically specialized and their expertise is limited to specific subjects. But climate change is a large subject, calling on the expertise of many different scientists, lawyers, and health professionals. When speaking out, professionals may be tempted to make pronouncements about matters beyond their area of expertise. Recall the criticism that James Hansen encountered when he ventured from his expertise on climate science to his advocacy of nuclear power.

When professionals are thrust into the public forum, they may feel that they are being evasive, even irresponsible, if they refuse to answer questions that are relevant and reasonable but go beyond their limited area of expertise. Naomi Oreskes describes what must be a common experience of climate scientists in dealing with the press.²⁵ As a geologist, she is knowledgeable about such matters as carbon sequestration, but reporters treat her as an expert on everything to do with climate change. She believes that “we need . . . to be witnessing professionals in our domain of expertise, but we also need to act with respect for colleagues who are the appropriate witnessing professionals in other domains.”²⁶ She keeps a list of experts in other fields, to which she refers reporters who ask questions that go beyond her professional competence. She doubts that most reporters, under deadline pressure, follow up. Her experience shows that even when scientists are scrupulous about their obligation to limit their witnessing to their area of expertise, journalists do not accept their claims of professional modesty. It is therefore not only scientists but also journalists and other professionals who must avoid the tendency to stretch expertise beyond its reasonable limits. That does not mean that professionals should never speak on matters outside their own field, but that if they do, they should make their qualifications clear. Misplaced expertise is a peril of witnessing that deserves constant attention from all professionals.

Some professionals are already responding to the call to bear witness to the harms that climate change is visiting upon the planet. They are reporting, warning, criticizing, and lobbying. We should encourage more to take up the cause, and not only the climate scientists but also physicians, lawyers, judges, public health officials, journalists, broadcast meteorologists, and undertakers. Part of the professional ideal of service demands witnessing. But I have also em-

phasized that, as professionals bear witness in the public forum, they should not neglect the other aspect of the professional ideal: the respect for professional authority. They must temper their witnessing with appropriate deference to the specialized knowledge that is the basis of their professional authority. The challenges of witnessing are great, but so are the harms that climate change threatens.

AUTHOR'S NOTE

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An Environmental Lawyer's Fraught Quest for Legal Tools to Hold Back the Seas

Michael B. Gerrard

The law is the principal mechanism by which society resolves disputes and implements policies. For more than forty years, I have worked to use the law to address environmental problems, initially by trying to stop projects that would increase pollution and harm communities. But there are limits to what the courts can do without explicit direction from legislatures. Climate change is a prime example. Some have seen litigation as a silver bullet, but at least so far that has not been the case. Elections matter more than lawsuits. Until and unless elections bring to power a president, a Congress, and local officials who will take the necessary measures, litigation is needed to inhibit those who will try to move backwards, spur on those with good intentions, help implement the policies set by wise Congresses past, and continue the quest for redress for victims. Well-crafted laws can also lead the way to solutions.

I was born in 1951 in a since-raised hospital on West 110th Street in Manhattan, six blocks from where I now teach at Columbia Law School. My parents were graduate students at Columbia, and after my father received his Ph.D. in sociology, we moved from town to town in search of a tenured position. In 1959, he landed one at a small college in Charleston, West Virginia. We moved there when I was entering third grade and I attended the Charleston public schools through high school.

We lived in a college-owned house on the banks of the Kanawha River. The Charleston area was and is a hub of the petrochemical industry. Union Carbide, Dow Chemical, Monsanto, FMC, and other companies built factories there, attracted by the cheap coal-generated electricity and the ability to dump waste into the Kanawha. Coal barges chugged back and forth all day and night, but there was little recreational boating – the river was so polluted that no one wanted to dip a toe in, and fishing was pointless. The air wasn't much better.

In 1968, a family friend, Paul Kaufman, a public interest lawyer and state senator, ran for governor of West Virginia on an environmental protection platform. I campaigned for him that summer when I was between high school and

college. Kaufman lost badly, but the campaign sparked my first interest in the environment.

I entered Columbia as a freshman in September 1968. The previous spring, the university had been closed when students protesting the Vietnam War (among other things) took over several campus buildings. Throughout my four undergraduate years, the school was still roiled by protests over the war and civil rights. But the environmental movement was also building. The first Earth Day was April 22, 1970. I covered the events on campus for the *Columbia Daily Spectator*; those were probably my first writings on the environment. I majored in political science and wrote my senior thesis on the politics of air pollution in West Virginia.

After graduation in 1972, I worked for the Charleston bureau of the Associated Press, and then for another failed campaign (McGovern for President). A few months after Nixon was reelected, I returned to New York. I briefly worked as a paralegal at a Wall Street law firm, where I met a wonderful young woman, Barbara Seuling, who also worked there as a paralegal while she put herself through law school. Barbara and I started dating (and married in 1976). I then got a job with the Council on the Environment of New York City, which was affiliated with the mayor's office. This was the era when most of the major U.S. environmental laws were being passed, and it looked to me that the most effective environmental work was being done by the lawyers. I decided to go to law school to become an environmental lawyer. NYU Law School offered me a full scholarship, and I enrolled there in 1975.

While I was at the Council on the Environment, a portion of the elevated West Side Highway, along the Hudson River, collapsed, and a proposal emerged to fill in one-tenth of the cross-section of the river and build an interstate highway in a tunnel through that landfill. The cost, about \$2 billion, would be paid 90 percent by the federal government and 10 percent by New York State. Congress passed a law, pushed by Representative Bella Abzug, to allow states to "trade in" interstate highway money for smaller replacement roadways and mass transit. Since the New York subways were falling apart, many of us advocated using this provision; the highway project, called Westway, seemed to be a gross misallocation of resources. I wrote a paper for the Council about how much more energy it would take to build and operate Westway than to rehabilitate mass transit. While at NYU, I became an intern at the Natural Resources Defense Council (NRDC) and continued fighting Westway.

My ambition during law school had been to join the NRDC or the Environmental Defense Fund after graduation, but they were still small organizations and had no entry-level jobs. I had gotten to know the lawyers who were representing the Sierra Club and the other opponents of Westway, and they hired me. The firm, Berle, Butzel & Kass, was a small environmental boutique representing citizen groups, municipalities, and government agencies. We continued the litigation against

Westway and ultimately won, largely because the Army Corps of Engineers had lied about how the landfill would harm the striped bass of the Hudson River.

I practiced environmental law at the Berle firm from 1978 until it broke up in 1994. I then moved laterally to the New York office of Arnold & Porter, a major law firm based in Washington, D.C., taking all my clients and several associates with me. While practicing law, I also wrote books about environmental law. In 1992, I started teaching a seminar on hazardous waste law at Columbia Law School as an adjunct. A series of court decisions had made hazardous waste, and the potential liability for cleaning it up, the hottest issue in environmental law.

The United Nations Framework Convention on Climate Change was negotiated in 1992, and the Kyoto Protocol, which was designed to implement it, in 1997. But the United States Senate refused to ratify Kyoto, largely because it did not require China and India to reduce their greenhouse gas (GHG) emissions. Congress also didn't pass any climate change laws, so climate change was not a major topic of U.S. environmental law practice; there was little law to practice. The books I was writing were focused on hazardous waste and other environmental topics.

Much of my practice was very rewarding. I represented several communities in preventing the construction or enlargement of landfills, incinerators, highways, and other environmentally destructive projects. I represented the Village of Mount Kisco in Westchester County, New York, in a successful fight against a golf course that Donald Trump wanted to build nearby that would have released pesticides into the Village's drinking water supply. I did much of the environmental review work in the reconstruction of the World Trade Center site after 9/11. I helped the City of Niagara Falls secure funds to build a new drinking water plant from the chemical company that had contaminated the old one. I defended the Metropolitan Museum of Art against neighbors across the street who were suing because they didn't like the construction disruption from the rebuilding of the Greek and Roman galleries. I tried many cases and argued many appeals, and I was able to turn down work I didn't like, such as fighting wind farms, homeless shelters, or affordable housing.

In the early 2000s, as I began to hear more and more about climate change, I thought about writing a book on that subject. I was very busy as chair of the Section of Environment, Energy, and Resources of the American Bar Association, but when my term ended in June 2005, I started work on a book that would be called *Global Climate Change and U.S. Law*. I educated myself on the subject and became extremely concerned. The book was published in 2007; I was invited to speak at numerous conferences, and the more I learned, the more worried I became. As I read yet more scientific studies about the perils of climate change, I began to feel guilty about not devoting myself more fully to this topic on which I had developed some expertise. I had become partner-in-charge of the 120-lawyer New York

office of my law firm, and a poll had twice rated me as the most prominent environmental lawyer in the world, but I was yearning to plunge into the fight against climate change.

In 2008, to my surprise, David Schizer, then the dean of Columbia Law School, contacted me to say they needed someone to join the faculty to teach environmental law, and perhaps I would be interested. After talking it over with Barbara, I called him back and suggested that I join the faculty to teach environmental law and start a center on climate change law. The center's purposes would be to develop legal techniques to fight climate change; to train the next generation of lawyers how to use them; and to develop legal resources for judges, lawyers, scholars, and students around the world. Dean Schizer quickly agreed.

So I resigned my partnership in Arnold & Porter (where I remain as senior counsel), was happy to give up my thirty-year habit of filling out a time sheet every day, and, in January 2009, became a full-time professor. I started that semester by teaching a course on climate change law; the registrar assigned me to a room that would hold twenty students, but it quickly became apparent that a larger room was needed. This was a time of great optimism for climate regulation. During the 2008 election campaign, both parties' presidential candidates (Barack Obama and John McCain) supported climate legislation; the issue didn't seem controversial. I joined Columbia the same month that Obama was inaugurated. In June 2009, the House of Representatives passed the Waxman-Markey Bill, which would have established an economy-wide cap-and-trade system and launched several other programs on climate change. The center I founded, later renamed the Sabin Center for Climate Change Law after receiving a large donation from a generous Long Island businessman named Andrew Sabin, prepared a database of the more than 150 rules that Waxman-Markey would have required so that we could track them and enlist Columbia scientists in the debates on how to shape them. We held a conference on Capitol Hill on preparing to implement the new law. We looked forward to the annual UN climate conference in Copenhagen in December 2009, where we hoped a new global agreement would be reached, much broader and stronger than the Kyoto Protocol.

But the industries that would be hurt by climate change mobilized very effectively. In late 2009, someone (the Russians are suspected but it was never proven) broke into a computer server in a UK university and stole and published more than one thousand e-mails among scientists. Right-wing media then took a few phrases from some of these e-mails out of context to make it appear that climate change science was a fraud. They accused a prominent climate scientist, Michael Mann, of falsifying studies. Several independent investigations established that all these accusations were nonsense. However, skepticism about climate science soared and (fueled by large campaign contributions from various fossil fuel companies and their owners) essentially captured the Republican Party. The Copenhagen confer-

ence was a bust, largely because President Obama could not promise much U.S. climate action; the Waxman-Markey Bill died in the Senate; and several Republican governors scaled back or eliminated their states' climate policies. Donald Trump, who in 2009 as a private citizen (together with Donald Jr., Eric, and Ivanka) had signed a full-page ad in *The New York Times* calling for international climate action, began tweeting in 2012 that climate change was "a Chinese hoax." The tremendous optimism of 2009 had soured, but the scientific case for urgent action was becoming even more compelling. To undermine this sense of urgency, opponents of climate action began attacking climate scientists legally and politically, and I participated in the formation of a group to help them, the Climate Science Legal Defense Fund.

In 2010 came another surprise. Phillip Muller, the permanent representative of the Republic of the Marshall Islands to the United Nations, approached me. He said his island nation, half-way between Hawaii and Australia, would in time be under water. That raised several novel legal questions: Is a country that is under water still a state? Does it still have a seat on the United Nations? What will be the legal status of its displaced people? Is there any recourse against those who did this?

Those were intriguing questions and I had none of the answers. So we convened an international conference on legal issues for threatened island nations, and with funds from the World Bank, flew in people from the Pacific island nations and elsewhere for three days of intense discussions at Columbia. During our formal dinner in the rotunda of Columbia's Low Library, the Marshallese delegation took the stage and sang Marshallese songs, led by the country's president on the ukulele. They were showing us that they have a culture worth preserving. Based on the talks at the conference, we produced a book that answered many of Muller's questions. The conference also helped lead to an effort by the Marshall Islands and another Pacific country facing similar perils, Palau, to ask the International Court of Justice in The Hague what are the obligations of the developed economies to slash their greenhouse gas emissions so that the small island nations do not drown. This effort was opposed by the Obama administration (which didn't want non-Americans telling the United States what to do), and did not garner the requisite majority vote of the United Nations General Assembly to get to the world court. But some of us are still trying.

I have traveled to the Marshall Islands twice. It requires getting to Honolulu, and from there taking one of the three weekly flights to the capital atoll of Majuro. (This assumes the Majuro airport is not flooded by the Pacific Ocean, which often happens. When it's not flooded but merely raining, the Marshallese capture the rainwater runoff from the runway as their principal source of drinking water; the underground water supplies on which the Marshallese relied for millennia have

become too salty as a result of sea level rise, or depleted by a growing population of people moving there from the “outer islands.”)

Preparing for my first trip to the Marshalls, I read up on their history. Archaeologists think they were first inhabited by Micronesian canoers about two thousand years ago. The country, with about 1,200 islands mostly grouped into twenty-nine atolls, took its name from a British sea captain who explored it in 1788. Germany established a protectorate over the Marshalls in 1886; missionaries converted most of the population to Christianity. The Japanese took over during World War I, and after heavy fighting, the United States seized the islands during World War II.

The United States found these islands – remote from everyone except the Marshallese, for whom it was their ancestral home – an irresistible place to test nuclear weapons after World War II. Between 1946 and 1958, the United States detonated sixty-seven nuclear bombs, mostly on Bikini and Enewetak Atolls. (The woman's swimwear item was named after this atoll, reportedly as something small and dangerous.) The people who lived there were relocated to other atolls, and then moved around as their new dwelling places were found to be too radioactive or unable to grow food.

Bikini Atoll has been deemed so contaminated that it will not be habitable for tens of thousands of years; only the cartoon character SpongeBob lives there. In an effort to make parts of Enewetak habitable again, the U.S. government began a cleanup program in 1958. Soldiers bulldozed much of the radioactive material left behind by the nuclear tests into the lagoon at the center of the atoll. The United States took the crater that had been left behind by one of the atomic weapons tests, threw in the worst material, including chunks of plutonium scattered around in a failed weapons test (collected into 437 plastic bags), and covered it with an eighteen-inch-thick cement shell.

There is no regular air service to Enewetak, but during my 2010 visit, there was a special flight from Majuro to dedicate a school that had been built with U.S. funds. The airplane carried the first lady of the Marshall Islands, the U.S. ambassador, and other dignitaries. The Marshall Islands government arranged for me to have a seat on the small plane, which couldn't make the seven-hundred-mile trip without stopping for fuel. So it landed in Kwajalein, home of the Ronald Reagan Ballistic Missile Defense Test Site, where the United States launches rockets and monitors any that might be launched by others (such as North Korea). The plane's operator, Air Marshall Islands, known locally as Air Maybe, had such poor credit that the pilot needed to carry a briefcase of cash to pay for the fuel. When we finally arrived at the Enewetak landing strip, we were greeted by women dancing to Marshallese music (wearing the customary mumus, definitely not bikinis) and given coconuts with straws to drink the juice. The dignitaries were put into a motorcade for the school dedication ceremony. I was directed to a small motorboat; three Marshallese men sped me across the lagoon to Runit Island. We passed

many small islands; there used to be more, but some were destroyed by hydrogen bombs. After about forty-five minutes, the boat ran up to a narrow beach. I was motioned to jump off. I followed one of the men through some scrub brush, and then saw the dome looming ahead. There were no signs, fences, or guards. My guide walked up the shallow incline of the dome and stood on its top; impulsively, I followed him. I wished I had brought a Geiger counter. I stood on top for perhaps a minute, looking at the vegetation that was growing between the cracks in the thin dome that separated me from the plutonium, which has a half-life of twenty-four thousand years. I then scampered off to catch the boat back to the plane for my return flight to Majuro.

I later learned that studies have shown that water under the dome rises and falls with the tides, so the inside of the unlined crater is in communication with the lagoon. The U.S. government acknowledges that the shell is cracked and could be blown off in a severe typhoon, dispersing its contents, but they say that would be harmless because, due to the residue from the nuclear tests, the radiation outside the dome is just as bad as that inside. Plutonium isotopes discovered in the South China Sea have been traced to the Marshall Islands, some 2,800 miles away.

Runit Dome, as it is known, is far from the greatest problem faced by the Marshall Islands. The highest point in the country is about two meters. When I asked one resident what they would do in case of a tsunami warning, the answer was, “climb up a tree.” Depending on what projections to believe – which depends, in turn, on future levels of GHG emissions, and on the pace of melting of the Greenland and Antarctic ice sheets – much of the Marshall Islands will be often under water by 2100. When (not if) the Marshall Islands are completely submerged, so will Runit Dome; but the islands will be uninhabitable well before that, because the roads will be cut off, there will be no local supply of food or fresh water, and flooding will be so frequent and dangerous that it will no longer be safe to live there.

In 1986, the United States negotiated a “Compact of Free Association” giving the Marshall Islands independence. They are now the Republic of the Marshall Islands, with a democratically elected government and a seat at the United Nations. The uninhabitable island of Bikini has a town hall on Majuro. The displaced people of Bikini still send a senator to parliament and go to the town hall to collect compensation checks. Many people in the country suffer from a variety of illnesses that they attribute to the persistent radiation.

The U.S. Congress established a Nuclear Claims Tribunal to adjudicate the claims of the Marshallese for damages from the nuclear testing. The Tribunal held years of hearings and awarded more than \$2 billion in damages, but Congress only appropriated \$150 million, and the U.S. federal courts ruled that they have no jurisdiction over the dispute. Thus, the United States has shafted the Marshall Islands in three ways: we dropped sixty-seven nuclear weapons on them; we estab-

lished a tribunal to judge their claims, but then never paid them; and now they are drowning from sea level rise that is caused in part by the United States. More than any other country, the Marshall Islands are the victims of the two greatest threats facing humanity: nuclear weapons and climate change.

The 1986 compact had another provision, in very partial recompense for the nuclear assault. Marshallese were given the ability to come to the United States without visas and work here permanently. About one-third of the country's roughly sixty thousand people have done so. In the mid-1980s, one Marshallese man, John Moody, happened to get a job at the Tyson poultry plant in Springdale, Arkansas. It went well, friends and relatives moved there and got jobs at Tyson, and today at least ten thousand Marshallese live in and around Springdale. The Republic has established a consulate in Springdale next to a barber shop. Candidates for president of the Republic campaign in Springdale. The children attend Arkansas schools; those who are born in the United States automatically become citizens. In a generation or two, these children will presumably be fully assimilated Americans. During a visit to New York for the United Nations General Assembly meeting, a former president (not the one with the ukulele) gave a talk at Columbia; I asked him in the public forum whether they have any plans to evacuate. He firmly said no – they are staying. That is the stated policy of every island nation; it seems to be politically toxic everywhere to admit that the homeland will have to be abandoned because it is going under the seas. But many in the Marshall Islands and the two other countries with similar agreements with the United States (Micronesia and Palau) are undertaking informal migration.

No other country endangered by sea level rise has such a deal. My work with the Marshall Islands led me to look more broadly at the issue of climate-induced migration. Coming up with estimates of the number of people who will be displaced by sea level rise, drought, and other extreme events worsened by climate change is very difficult; we don't know how much GHG concentrations will rise in the decades to come, and much migration is due to a combination of factors: climate change, political and ethnic conflicts, and high unemployment, among others. The estimates vary widely, but it is broadly (though not universally) accepted that by the end of the current century, at least one hundred to two hundred million people globally may be displaced largely as a result of climate change.

These people are not legally classified as refugees. That term applies to people who are forced to flee their home countries as a result of persecution or the reasonable fear of persecution. Climate change does not count. Countries have no obligations to take them in. (As the appalling experience at the southern border during the Trump administration has shown, even people with a colorable claim to refugee status will not always be treated humanely.) A just solution might be for each major emitting country to take in a number of climate-displaced people roughly proportional to its share of the greenhouse gases in the atmosphere. The

United States is now responsible for about 25 percent of the load of GHGs. (China contributes more on an annual basis, but GHGs last so long in the atmosphere – carbon dioxide, more than a century – that their cumulative load has not yet caught up to the United States.) If one hundred million people are displaced, it's easy to do the math on how many people we should take in. But the politics of this are completely impossible – certainly now, but perhaps in any imaginable future.

The number of people in the small island states is small enough for the international community to absorb them. But what will happen if and when tens of millions of people in Bangladesh need to escape the rising seas and saltwater intrusion into their water supplies, at the same time that millions of people on the coastlines of India, Pakistan, and Myanmar are also moving inland for the same reasons, and perhaps millions more are displaced because the retreat of the Himalayan glaciers due to global warming is drying up the rivers that people need for their water? The history of South Asia does not suggest that the Bangladeshis will be accepted with open arms by their neighbors, who are themselves in great distress. And this is on a subcontinent with two countries with nuclear weapons. When people ask me what about climate change gives me nightmares, this is at the top of the list.

One of the great frustrations for lawyers is that there seems to be little that our legal systems can do to address this looming migration crisis. A core principle of international law is that states cannot be compelled to join treaties without their consent. Several NGOs and academic groups have drawn up model agreements on internal and cross-border migration (and my Columbia center has participated in some of this), but so far no major countries have agreed to be bound by these treaties. Human rights tribunals can make findings and issue reports, and many of them have already done so with respect to climate change, but almost none of them have the legal authority to compel remedies or award damages. The United Nations can urge action, and in 2015, I addressed a special meeting of the UN Security Council calling on them to do that. The world's religious leaders can call upon their followers to behave justly toward their fellow humans, and in 2016, I spoke about climate displacement at a conference in Vatican City convened and attended by Pope Francis. We can raise our voices in these forums and hope to move some minds. But neither the UN nor the pope can force action. That power lies within each country's own government, and tragically, the global tide of right-wing populism has led several countries (led by Trump's America) to abandon any compassion for suffering outside their borders, or by disfavored populations within their borders.

Mass migration may be the worst impact of climate change. But over the past decade, I have also worked on its causes and on how to cope with its other impacts.

The root cause of anthropogenic climate change is GHG emissions. In the United States, about 75 percent of that comes from the combustion of fossil fuels. (Most of the rest is due to industrial processes and agriculture.) So the core task in fighting climate change is reducing the use of fossil fuels.

In 2011, the American Bar Association published a book I had edited, *The Law of Clean Energy: Efficiency and Renewables*. I teach a course on energy regulation and emphasize these subjects, but my greatest engagement with them came after the publication of a series of reports in 2014 and 2015, *Pathways to Deep Decarbonization in the United States*, from the Sustainable Development Solutions Network (SDSN, which is associated with Columbia) and the Institute for Sustainable Development and International Relations (IDDRI, based in Paris). These reports laid out in considerable detail how the United States could radically reduce its GHG emissions. There were three pillars: energy efficiency; decarbonization of the electricity sector (meaning no more use of coal to make power, or natural gas without carbon capture and sequestration, and major increases in renewable energy and possibly nuclear energy); and conversion of most uses of liquid fuels (led by transport and by space heating and cooling) and gaseous fuels to renewables.

I began asking the question of how U.S. law needs to change to be on this pathway. I learned at a conference that another law professor, John Dernbach of Widener Commonwealth Law School in Harrisburg, Pennsylvania, was asking the same question. So John and I decided to team up and coedit a book that would address the question. We divided up the recommendations in the SDSN/IDDRI reports into more than two dozen chapters. We then added several topics that those reports had not included in any detail, including agriculture, forestry, carbon taxes, materials consumption, non-carbon dioxide GHGs, and several others. We set about to find legal experts – mostly law professors but also some practitioners – to write the chapters. We started in mid-2015 and hoped to finish the book in time to present it to an incoming Hillary Clinton administration. But neither our timing nor the 2016 election turned out as we hoped. The end result was finally published in April 2019 by the Environmental Law Institute (ELI) as a nearly 1,200-page book, *Legal Pathways to Deep Decarbonization in the United States*, with thirty-five chapters by fifty-nine authors. This was entirely a pro bono effort; John and I waived royalties, the chapter authors all worked for free, and ELI sells the book below cost.

The book has more than one thousand recommendations. John and I didn't want it to simply sit on the shelf, so we enlisted Richard Horsch, who had recently retired as an environmental partner at the law firm of White & Case, to lead an effort to recruit pro bono law firms to draft the model laws recommended by the book. More than twenty law firms have signed up, and we're looking for more. Other lawyers have volunteered to serve as peer reviewers for chapters in their areas of expertise. Marcy Kahn, who just retired as a justice of the New York State Supreme Court, Appellate Division, has agreed to lead that peer review effort.

Joseph DiMona, who recently retired as a corporate general counsel, is helping lead what we see as the next stage: pushing our model laws out to Congress, state legislatures, city councils, and other bodies with the authority to enact them. We are also working with law professors in Brazil, the European Union, and Australia to try to replicate our project in those places.

This project has revealed several things about the law and about lawyers.

First, about the law. There are many legal tools that can be used to advance the decarbonization effort. These include regulatory mandates; incentives; information provision; clearing away legal obstacles; market mechanisms; and many others. A price on carbon, such as through a carbon tax, would be very helpful. But (contrary to the views of some economists) it would not be enough; there are many problems that a carbon tax alone cannot solve. The legal tools need to be deployed at every level – federal, state, and local – and the executive, legislative, and judicial branches must be engaged at each level. So must corporate and NGO board rooms, mass and social media, and others. The different economic sectors and technologies that emit GHGs are so varied that one size does not come near to fitting all.

Second, about lawyers. A great many lawyers are yearning to deploy their professional skills to fight climate change. This ranges from law students and junior associates to retired partners. Environmental and energy lawyers have the most obviously relevant expertise, but these are also the most likely to have client conflicts in undertaking this work. But lawyers in such transactional areas as corporations, finance, taxation and real estate, and many others have much to contribute. Big law firms mostly represent big companies – that’s who can pay their big fees – but we’ve usually found ways to navigate the danger of client conflicts. A law firm that represents oil companies, for example, would not want to draft the laws that directly hit oil companies (leave those to other firms), but might be fine with working on energy efficiency or on renewable energy, for example.

The SDSN and IDDRI reports were eye opening in another respect. If we transition to all-electric passenger cars, switch space heating and cooking to electricity, and follow the other recommendations on electrification, we need to about double the nation’s electricity supply, even after an aggressive program of energy efficiency. When we also shut down all the coal plants and most of the natural gas plants, and recognize that most nuclear power plants will be retiring and we’re unlikely to build any new ones in the next few decades, that means that a phenomenal number of renewable energy plants will need to be built: mostly wind and solar, but also some hydroelectric, geothermal, and others. This is a massive, nationwide, multidecadal construction endeavor. But many of these projects will be opposed by neighbors and others who don’t like the sight of wind turbines, the associated power lines, and other facilities. This “not in my backyard” opposition has proven to be a major obstacle to achieving the necessary scale of clean energy. (As noted earlier, I used to do a lot of opposition work myself, though not against

renewable energy projects.) So the Sabin Center has launched the Renewable Energy Legal Defense Initiative, which provides pro bono legal assistance to community groups and others that favor these clean energy projects that are facing local opposition. My old law firm Arnold & Porter joined in by seconding a litigation associate, Laura Cottingham, to spend half her time over a year working on this project and launching our first legal actions.

Regardless of our best efforts, the world will get a lot hotter in the decades to come. And we're not making our best efforts; despite all the UN agreements and pledges, the world's GHG emissions continue to climb. Thus, it is essential to help prepare for what's coming: more severe floods, heat waves, wildfires, droughts, disruptions of water and food supplies, and everything else.

Here, too, there is much the law can do. Flood maps, zoning codes, building codes, infrastructure specifications, insurance requirements, and many other tools are available. In 2012, the American Bar Association published *The Law of Adaptation to Climate Change*, edited by Professor Katrina Fischer Kuh and me, that explores these legal tools in detail.

Hurricane Sandy hit in October 2012, shortly after this book appeared. It caused widespread electricity blackouts. The Sabin Center petitioned the New York Public Service Commission to require all the utilities it regulates to devise plans to prepare for future climate-related extreme weather events. Shortly afterward, New York City's electricity provider Con Edison filed for its next rate increase, which included \$1 billion for storm hardening. This would help prepare for the next Hurricane Sandy, but there are many other extreme events that could harm the electricity system, such as heat waves. So we brought some Columbia climate scientists before the top executives of Con Edison to explain the latest projections. The company is run by engineers who understand math and who value electric system reliability above almost all else; they got it. We then formally intervened in the rate case and participated in a negotiation process that was expertly presided over by an administrative law judge, Eleanor Stein. (In 1969, she had left Columbia Law School after being jailed for antiwar activities. Some things come full circle.) The talks led to a settlement agreement under which Con Edison hired outside climate scientists to prepare projections about future climate conditions in their service territory; examined how those conditions could affect system reliability; and devised ways to prepare for and cope with those conditions. Con Edison (after some startup delays) did the required studies and is now preparing the plan to implement the recommendations.

This is one particular example of how legal processes can be used to help prepare for climate change. Not enough of this kind of work is being done. It's less glamorous than suing oil companies, and it tends to promise no more than local benefits, but it will be an important part of coping with the hot world to come.

The term geoengineering is much used and often vilified. But it really involves two quite separate kinds of activities. The first is absolutely essential, and might be done with little risk, though at great expense. The second is terrifying and risky, but regrettably I think someone is likely to try it, and it doesn't cost that much.

The first is carbon dioxide removal: taking out some of the carbon dioxide that is already in the atmosphere, and either storing it temporarily, as in trees, or permanently, as in geological sequestration, or using it, as in some building materials or fuels. The recent scientific reports make clear that carbon dioxide removal will be needed on an utterly massive scale. Many technologies are being developed (though not nearly enough money is going into the necessary research, in view of the importance of carbon dioxide removal in the overall climate picture). These technologies all raise legal issues, but none of them seem insurmountable. For example, my Sabin Center colleague Romany Webb and I, along with scientists at Columbia's Lamont Doherty Earth Observatory, are working on the legal issues surrounding the long-term storage of carbon dioxide in basalt formations under the Atlantic and Pacific Oceans. Some laws would need to be changed to allow this to happen, but it's not difficult to imagine what these would look like.

The second kind of geoengineering is solar radiation management: reducing the amount of sunlight hitting the earth. The most likely technique would be using a fleet of airplanes to spray aerosols into the stratosphere. We know from volcanoes that this could reduce global temperatures a degree or two, which would make a big difference to the climate. But there is real concern that it could disrupt natural systems and weather patterns in unpredictable ways, and if things went wrong, could have extremely negative impacts on some regions of the globe. Already several Hollywood films have painted some dire scenarios.

I liken solar radiation management to chemotherapy for the planet. If you're dying of cancer, you may agree to inject toxic chemicals into your body: they will make you very sick, your hair will fall out, they may kill you, but they may also save your life. If the earth is facing crucial tipping points – which some scientists believe may already be happening – it may be rational to take risky steps that have the potential to avoid some of the worst impacts of climate change. However, here the legal issues are very difficult, even at the conceptual level. Who would have the power to undertake this effort? How much certainty about necessity, risks, and benefits should be required before deployment could begin? If something goes wrong, who pays? How would it be determined whether a given negative weather event in some part of the world is caused by the solar radiation management or by natural systems? If some rogue actor were to deploy this technology without the necessary international authorizations (if such were required, which they're not yet), how would a decision be made to stop it, especially if military force is required?

In 2018, Cambridge University Press published a book that I coedited with Tracy Hester, *Climate Engineering and the Law: Regulation and Liability for Solar Radiation Management and Carbon Dioxide Removal*, which explores these issues in depth. Perhaps because of this, the Harvard University provost's office invited me to join the advisory committee for an experiment that some Harvard scientists have proposed, called SCoPEX, that would involve launching a balloon into the stratosphere, spraying a small amount of nontoxic material (probably ice and calcium carbonate), and seeing how it behaves. This project itself would have no environmental impact, but it would inform future thinking about whether solar radiation management could actually work, and if so, how. I accepted the invitation because I fear that the planet might need this kind of chemotherapy some day, and also because it's entirely plausible that some country or nonstate actor will try it regardless of international opinion, and it's important to know as much as possible about the likely positive and negative impacts.

Shortly after the membership of this advisory committee was announced in August 2019, we all received a petition, signed by quite a few (mostly small) environmental groups around the world, urging us to resign. The two main reasons given were that deployment of solar radiation management could be dangerous, if something goes wrong, and that the potential availability of this technique poses a moral hazard: a danger that countries and companies will use it as an excuse not to do everything possible to reduce their GHG emissions. None of us have resigned. As to the first reason, the experiment itself is tiny; so far as we can tell, it cannot possibly have negative environmental impacts. We do not yet know enough to assess the risks of full deployment; the proposed experiment may give us a better handle on what they are. It will not lock us into anything. As to the second reason, we haven't seen any evidence that discussion of solar radiation management is actually impeding serious efforts to reduce GHG emissions. A decade ago, it was taboo in many circles to talk about adaptation to climate change, because of the same moral hazard concerns; that argument has mostly gone away with greater recognition of the necessity of adaptation. We think the same thing may happen here. But the advisory committee is still in the early stages and we have reached no conclusion about whether to recommend that the experiment proceed.

The Sabin Center attempts to track all the climate change litigation in the world (by which we mean lawsuits that explicitly raise climate change as an issue). By our latest count, there are more than 1,452 such cases in thirty-seven countries. The United States is by far the leader, with 1,134 cases; Australia is a distant second with ninety-five. Most of the lawsuits are about specific facilities or regulations, but a handful attempt to be a "silver bullet": that is, an effort to address a country's GHG emissions all at once.

One such lawsuit has succeeded: *Urgenda Foundation v. Kingdom of the Netherlands*. In December 2019, the Dutch Supreme Court upheld rulings of the lower courts that the European Convention on Human Rights obligates the Dutch government to reduce the country's GHG emissions even further than its pledge under the Paris Climate Agreement. This is the only court case in the world that, without benefit of a specific legislative statute, required the government take stronger action on the causes of climate change. This litigation has inspired similar lawsuits in several other countries; so far none have succeeded, but a few are still pending.

There have been several such lawsuits in the United States. Most have been dismissed, but the one that got the furthest was *Juliana v. United States*, brought to federal court in Oregon in 2015 by twenty-one young people claiming that an ancient legal doctrine, the public trust doctrine, requires the government to protect the atmosphere from dangerous climate conditions, and that this requirement is embedded in the due process clause of the Constitution. This theory is highly controversial among legal academics, but the suit inspired much hope (and fundraising). The suit did not go as far as *Urgenda*; it sought a court order that the federal government produce a plan to radically reduce emissions (one step removed from actually reducing emissions). However, in January 2020, a divided Ninth Circuit Court of Appeals rejected the lawsuit. The court was convinced that climate change causes a grave danger and that humans are mostly responsible, but the majority found that the courts were powerless to act; solving the problem (which the dissenting judge likened to an asteroid hurtling toward Earth) was the job of Congress and the executive branch. The plaintiffs have vowed further appeals but the odds seem slim, especially with the current Supreme Court.

Fifteen lawsuits have also been brought under state common law against fossil fuel companies, mostly by cities, counties, and one state (Rhode Island) seeking reimbursement for the costs of adapting to climate change, such as the construction of sea walls. In 2011, the Supreme Court dismissed a similar lawsuit brought under federal law; a major issue in the current cases is whether that decision governs these cases brought under state law. So far the courts are split on that issue, and the Supreme Court has been asked again to weigh in.

Climate change litigation is burgeoning around the world. Because governments and legislatures everywhere have failed to take adequate action, activists are looking to the courts. Lawyers are scrambling for legal theories that might be available. Apart from the many legal niceties that impede success in these cases, there is a fundamental set of interrelated problems. Should unelected judges be able to override the decisions of elected officials? What is the appropriate separation of powers among the branches of government? Does the fundamental threat that climate change poses to humanity empower the courts to override the other branches, and if it does, how will the courts enforce their rulings? Who should be able to make the necessary trade-offs among the economic interests of the coun-

try where the court sits, the interests of other nations, and the interests of future generations? Faced with these difficulties and many others, almost all judges have decided that this isn't their role.

In the United States, the courts have played an essential role in making sure that the federal government obeys the laws that Congress has written. In 2007, in the landmark case of *Massachusetts v. EPA*, the Supreme Court (by a 5–4 vote) overruled the position of the George W. Bush administration that the EPA lacked the power to regulate GHGs. The Obama administration used that ruling to move forward on climate action, but in 2016, the Supreme Court (by another 5–4 vote, but going the other way) halted the most important effort, the Clean Power Plan. The courts have blocked numerous efforts by the Trump administration to dial back environmental protections, but mostly on procedural grounds. The statutes are still in place, but they are getting very old. Congress has not passed a major environmental law since 1990 (with the sole exception of an industry-supported toxics law in 2016); partisan divisions since then have blocked any new laws. So the courts are mostly reduced to enforcing laws written a generation ago, before the perils of climate change were so apparent.

There may be no legal silver bullet that will solve the problem in one shot. Even *Brown v. Board of Education* (1954), the best-known Supreme Court decision calling for a fundamental shift in a core aspect of society, did not lead to much actual school desegregation until Congress and Presidents Kennedy and Johnson took action a decade later. But there are hundreds or thousands of silver buckshot: smaller legal actions at every level that can add up to significant progress in avoiding the worst impacts of climate change and coping with those that do occur. Finding suitable targets amidst a galaxy of possibilities and shooting that buckshot are the best that we lawyers, as lawyers, can do. As citizens, we could have an even greater impact by helping elect a president, a Congress, and state and local officials who will, at last, take the needed actions.

This all became much more personal for me in April 2018 when Barbara and I were blessed by the arrival of our first grandchild. Our second came in August 2020. Today, nothing motivates me to fight climate change more than holding our Amelia and her little cousin Neri, who should still be around in 2100, and thinking about what kind of world they will live in. I don't know if my professional work will actually help give them and their generation a better world, but it is profoundly satisfying to know that I'm trying my best.

ABOUT THE AUTHOR

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Racism as a Motivator for Climate Justice

Mark A. Mitchell

In the wake of the recent unjustifiable deaths of George Floyd, Breonna Taylor, and several other African Americans at the hands of police, we have witnessed persistent and widespread protests against systemic racism, even during the COVID-19 pandemic, which has killed African Americans and Latinos at two to three times the rate of Whites. Racism is undeniably an evil, pervasive, destructive force in our society, yet it can also be a great motivating force. This essay is a personal story of how being the subject of racism led one person to acquire and leverage his professional privilege to help create and change institutions to act on climate and environmental injustices while countering the systemic racism that he witnessed and experienced in childhood.

Do you believe in a parallel universe? I do. I live in one. This is not the “fake news” universe, but rather the universe of racism. Racism is pervasive in American society and is a strong but silent social determinant of health, wealth, and general welfare. It creates a parallel universe where people living in the same environment have very different lived experiences. It can also be a powerful motivator for good or evil. This essay describes how my experience with overt, institutional, and systemic racism motivated me to become a witnessing professional for the health effects of climate change, and how I brought along other health professionals to that task.

In 1964, my family was the first African American family to move into one of the all-White suburbs of St. Louis. There, as a young boy, I experienced extreme, overt racism. At the age of seven, I did not understand why certain random strangers hated me and others were scared of me. I was called hateful names that I didn't understand by children from passing school buses or on the playground. Women twice my size would slam the door in my face in terror when I asked for donations for the March of Dimes. Virtually everyone would stare at me, smile, and lock their car doors when I crossed the street, clearly but silently letting me know that I did not belong. Relatives would complain that on their way to visit us they were frequently stopped by the police.

Over the next few years, I struggled to figure out how to keep people from hating me or being scared of me. I tried getting to know some of the haters, so that I could understand them, and they could understand me. I tried smiling and be-

coming the class clown. I tried fighting and arguing with those who bullied me, but this only seemed to encourage some to try to provoke me further. I also tried becoming the teacher's pet and excelling in my schoolwork to show that I was just as good as my classmates. Nothing seemed to work, and I became frustrated and depressed by the time I reached nine years old.

In my first year attending a more diverse high school, which was only 90 percent White, I woke up one day – as if struck by lightning – and decided that I would change my life. I decided that it doesn't matter what others think of me, I will do what makes me happy and stop trying to please everyone else or to be what I thought that they wanted me to be. I decided that it was too emotionally draining to be angry or to try to conform to unattainable expectations. I decided that I would create the life that I wanted. I decided that I would not judge others and would not worry about how they judged me, because I could never satisfy everyone. I decided that just because something was a rule or a norm didn't make it right. I decided to defy social norms by rotating among the cliques that ate together in the cafeteria. One day I would eat with the jocks, the next with the thespians, the druggies, the intellectuals, the elites, the Black students, the nerds, and so on. However, I still disdained those who spouted racial slurs and jokes, and I knew that I was always being watched, always being judged, and always at risk of upsetting White people for little or no reason, which could get me in trouble or put me in danger.

To my surprise, despite or because I stopped trying to please everyone, I became popular, particularly among students who did not fit in. I found that others wanted the same things that I did, and although life is unfair, together we could change the unfair institutions and make them more just. I started organizing students to oppose perceived injustices. I joined the student council and restarted the Black Student Union during my Freshman year and continued being active in these and several other organizations over the course of my matriculation there. I was surprised that, in my Senior year, my classmates created a special Student Council officer's position for me to serve as a platform to organize students to address injustices.

I had decided that I wanted to go into medicine from a very young age as a way to help others and to challenge myself academically. I was accepted into a six-year medical school upon graduation from high school, and continued my student activism there in Kansas City, Missouri, through the student council and the Student National Medical Association (which represents African American medical students), and by participating in medical school policy-making bodies, such as the admission committee. Because my youthful experiences led to various levels of success and appreciation from others, I decided that I wanted to focus my life on changing policy, fighting racism, and pursuing social justice. I tried to figure out how to combine this with a career in medicine. One day, one of my profes-

sors advised me to explore Preventive Medicine and Public Health as a specialty. He helped me to locate Dr. Richard Biery, the Director of the Kansas City Health Department and one of only five public health-trained physicians in the 1.5 million-person Kansas City metropolitan area. I arranged a meeting with Dr. Biery, who taught me that the philosophical basis of science is to find truth; the philosophical basis of medicine is to apply science to health; and the philosophical basis of public health is to apply social justice to medicine.

After he explained that to me, I was hooked. I decided I wanted to go into public health as a career.

I studied public health and completed my medical residency in Preventive Medicine. I entered the field and practiced public health in senior positions at the Kansas City, Missouri, and later, Hartford, Connecticut, health departments. Through this experience, I found that although social justice is the philosophical basis of public health, this is not how things work in reality. I found that there are many constraints on public health practitioners – namely, political constraints – particularly if you lead a health department. Health departments are sometimes described as the fourth-most political department in local government, after police, fire, and public works.

There were political pressures from a variety of constituencies, including City administration, state, and local elected officials, the three employee unions in our department, regulated businesses, health care organizations, community activists, and the media. We were often in the local news. Some of the issues that were highlighted in the media included: protests of cutbacks in child health programs; measles, tuberculosis, and sexually transmitted infection outbreaks; immunization campaigns to stop measles; needle exchange programs to combat HIV; closing popular restaurants that failed inspections; protests that claimed the family planning program somehow promotes sexual activity and abortions; and removing families from apartments where children have been lead poisoned.

In addition to these normal public health issues, we also encountered a number of extraordinary activities. These included drug charges against employees, embezzlement, arson investigations, and several fatalities of employees and their families, including a mass murder-suicide. This was a stressful four years, indeed.

Yes, I went into public health, but once there, I learned how stressful and political it can be and how many limitations there are on what you can do (although these vary from place to place around the country and according to the level of government – local, state, federal – in which you serve). Because of political limitations, it is not easy to be a witnessing professional or to promote change in public health.

One concern I observed that calls for witnessing professionals is that the people who need the resources the most are not necessarily the ones who get them, even though philosophically that should be the case. Often-

times the people who complain the most – those with the most political power and money – are prioritized for getting resources and services. For example, although we know that cancer rates and toxic exposures are higher in low-income communities, and even higher in communities of color, the state health department unit that investigates cancer clusters spends most of its time investigating whether there are cancer clusters in suburban and rural communities; they seldom find any. Why focus on these communities? Because suburban and rural residents are more likely to complain and to engage powerful interests to support their complaints. The lesson I learned from this is that the people who wield the most power and influence are those who represent business interests or those who work in advocacy groups that engage politicians and voters. In addition, powerful political interests often operate to create state policies that disadvantage urban interests. One example of this is how waste disposal is regionalized in Connecticut and concentrated in the cities with the highest percentages of People of Color.

Although Hartford is the state capital of the wealthiest state, it is among the lowest-income cities with over one hundred thousand people in the United States. It is 80 percent African American and Latino. In the 1990s, when I was health director, Hartford had the largest landfill in the state, and it was poorly managed.

It also had the largest trash incinerator in the state, which took trash from over seventy municipalities in three states to burn in Hartford. It was the fifth-largest trash-to-energy incinerator in the country, by capacity. Incineration produces toxic gases, which include nickel and phthalates that are associated with asthma. Hartford had the highest asthma hospitalization rate in Connecticut.

The landfill and trash-to-energy incinerator were both run by a quasi-governmental agency controlled by the Governor. Their Board was composed of current and former elected officials and was chaired by the Governor's Chief of Staff. It had state legislators as employees and contracted with companies of major political donors. It was supposed to be regulated by the state environmental agency, but when they tried to do so, the legislature enacted laws that exempted the quasi-governmental agency from the regulations. The landfill created odors that were so strong that on several occasions they made employees in the nearby Hartford Public Works garage so sick that they had to close their operations. Actions by community groups were able to exert enough pressure to get the facility to meet environmental standards. Although the landfill eventually closed, the trash-to-energy facility is currently in discussions to be gutted and rebuilt in the same location, perhaps with a larger capacity than it currently has to become one of the three largest facilities in the United States.

Another example that I observed as Hartford Health Director of how political power creates state policies that disadvantage communities of color was with electric power plants. New electric power plants, which were among the most polluting facilities in the state of Connecticut, were mostly placed in the communi-

ties with the lowest incomes and highest percentages of People of Color. These communities were the most densely populated portions of the state with the most air pollution and the highest rates of pollution-induced asthma hospitalizations and deaths. These communities were home to the state's largest existing power plants that already produced more electricity than these cities needed, and yet were the site for proposed new and expanded power production. This electricity was needed because of the growing wealthy suburbs with larger and larger mansions that needed to be air-conditioned in the summertime. Wealthy suburbanites wanted electricity, but refused to have the smoke stacks, air pollution, and electric power lines (with their "dangerous" electromagnetic waves) that would accompany electric power plants in their exclusive communities. In fact, they opposed high-voltage electric lines that would bring electricity to their communities from far away because they "obstructed the view of the woodlands," according to the well-heeled Woodland Coalition, an organization that sprung up to oppose power plants in wealthy suburbs. Therefore, the only possible outcome was to locate these new power plants in the nearby low-income, majority–People of Color urban areas. According to their logic, suburban residents have a right to as much electricity as they can afford, but no obligation to bear the negative consequences of it.

These are examples of *institutional racism*: although the policies are not racist on their face, they have disparate effects on communities of color.

While I was at the Hartford Health Department, I observed that although most diseases were decreasing in frequency, those that were related to environmental exposures—like cancer and respiratory conditions—were increasing. This appeared to be even more pronounced in African Americans and Latinos, contributing to increased health disparities. Yet it was the regulated community—not the public—that voiced their opinions on the health effects of environmental exposure, and it was to complain about perceived overregulation, when it was clear to me that they were not being regulated enough to prevent environmentally induced illness. I realized that at that time, the public had no idea they were suffering from environmentally related diseases.

Shortly after I left the Hartford Health Department, I was asked to conduct camp physicals for a group of about thirty Latino children for an urban church camp. I found that about one-third of the children had asthma, which is much higher than the national rates of less than 10 percent. I contacted a colleague at the state health department who was responsible for investigating environmentally related diseases. I was told that they would not investigate whether there was an environmentally related cluster of asthma because there were only thirty children examined, and it is not unusual for inner-city children to have asthma. I was outraged. I decided that I was going to do something about it.

This experience motivated me to start an environmental justice organization in 1998. At that time, environmental justice was a new concept. People didn't know what environmental justice was. They did not know that communities of color bear a disproportionate share of environmental hazards and suffer the health consequences from exposure to those environmental hazards. So I founded the Connecticut Coalition for Environmental Justice and was able to educate the public about the links between environment and health and the disproportionate burden of exposure to environmental hazards on African Americans, Latinos, and low-income people of every race. The low-wealth residents who I was training did not know that it was unusual for people to have that level of exposure to environmental toxins, as it was a normal part of their lives. Few of these people had confidence that they could get powerful people to change their situation. But we were very successful: we were able to change a substantial amount of environmental health policy over the ten years or so that I was there.

We saw proof of our effectiveness in influencing policy when a city council member came up to me and said, "Mark, you've got old ladies talking about things we can't even pronounce, so this **MUST** be important." Well, I had warned the council about the dangers of that exposure before, but when an individual scientist or physician says something it is often not enough. When an organized group representing constituents say the same thing, policy-makers more often perceive it as important, and decide to act.

In addition, we were able to get substantial actions on asthma. We got Environmental Protection Agency (EPA) funding to conduct a community-based randomized, door-to-door survey on asthma prevalence and environmental health symptoms. In a reversal, we had the city and state health departments and hospitals named to an advisory committee to advise the community, which decided on the questions that went in the survey. The survey eventually determined that the city-wide asthma rates were upwards of 20 percent. Other accomplishments were that:

- We were able to get the Hartford City Council to declare an "asthma emergency," which included the actions that we had decided.
- We were able to get funding for a City environmental health educator.
- We were able to get funding for the State Health Department to hire two asthma specialists.
- We were able to launch a successful anti-diesel campaign, which increased public awareness, reduced school and transit bus idling, and replaced the whole Hartford school bus fleet with buses that were 90 percent cleaner.
- We were able to get state funding and launch a grassroots asthma education campaign.

- We were able to get the trash-to-energy incinerator to reduce air pollution.
- We were able to get the state environmental agency to deny an air permit for an electric power station in New Haven, based on environmental justice impacts, for the first time in its history.
- We were able to pass a state environmental justice law, which is still one of the strongest community notification laws in the country.

And, most important, we were able to build a multiracial organization led by grassroots People of Color and low-income people who became community leaders and engaged citizens. Most of our leaders said that they had never voted before joining our organization because they didn't know how or why, and, although this was not our intention, we started swaying elections in Hartford and New Haven. In both cities, they elected the first Green Party candidates in their history when the Democrats and Republicans opposed our agenda. The New Haven Mayor's Chief of Staff told me that part of his duties was to determine our agenda so that the city could co-opt it. At one point, we were getting at least one state law passed per year. As we trained community residents to speak about their experience and needs at public hearings and in meetings with elected officials, they observed what officials were or were not doing to support these community efforts. The issues that our group decided to focus on proved to be of concern to much of the community. As our members talked to their relatives, friends, and neighbors, they told them about what was occurring and how elected officials were responding or not responding. These actions and word-of-mouth discussions eventually built up to the level that it began to make a difference in the election outcomes as well as in achieving more policy successes, especially on the local level.

The climate justice movement started developing in the early 2000s. It was based on applying the environmental justice principles of fighting structural and institutional racism to climate pollution. We fought laws that did not appear to be racist on their face, but were in fact racist in their effect. One example is a proposed law to give tax breaks to build unwanted, greenhouse gas-spewing power plants in economically distressed communities. These facilities create very few jobs but have high rates of pollution with resulting respiratory disease and death and contribute to global warming.

We also experienced differential applications of the same laws, such as those that determined which power plants were required to be upgraded to modern pollution controls rather than being grandfathered in. Public hearings for a major pollution source in Bridgeport were held the week of Christmas, which predictably led to minimal public participation. Bridgeport is Connecticut's largest city and its population is also majority People of Color. These types of activities would never be tolerated in wealthy, White suburban communities.

The movement to address climate change was an easy transition for environmental justice groups: we were used to trying to fight sources of air toxics that posed existential threats that killed many of our neighbors, friends, and families. We defined the environment as where we live and understand how our health is affected by that environment. Our concerns about how laws are commonly manipulated against our communities were often ignored by the larger climate organizations and health organizations whose members did not face the same threats. For example, the big environmental groups supported cap-and-trade policies to reduce greenhouse gas. Our experience in Connecticut was that when we finally won pollution reductions from our trash-to-energy facility in Hartford, the city with the greatest percentage of People of Color in the state, the facility operator was allowed to trade pollution credits with the trash-to-energy facility in Bridgeport, the city with the second-largest percentage of People of Color, so that they did not have to reduce their pollution there. To add insult to injury, they then bragged that the EPA says that they are so clean that they can sell air pollution credits – even though they were, by far, the largest polluter in Hartford.

So when the large environmental organizations tried to promote cap-and-trade legislation in Congress, environmental justice organizations sided with Republicans to oppose it. The legislation did not pass. The approach that environmental justice organizations favored, carbon tax and dividend, has since become much more popular.

It was clear that the people who contributed least to climate change were the most affected, both on a national level – as evidenced by who was left behind during Hurricane Katrina – as well as on an international level, with small island nations being ravaged by hurricanes and existentially threatened by sea level rise. Yet their views and experiences are often not taken into account in policy development. When they are not invited to the decision-making tables, the policy solutions tend not to benefit those who are suffering the most and are often less likely to be successfully implemented. The most effective policy seeks and incorporates the knowledge of those who are most impacted. The “experts” don’t know that many people will not get on an evacuation bus without their pets and without knowing where it is going. They don’t know that children sneak through the holes in the fence and play on the contaminated site, which their mothers, who have been kept in the dark about its dangers, think is safer than playing in the streets. They don’t know that even though there are two roads shown on the map that can be used for emergency evacuation, one is a dirt road that is overgrown with weeds and blocked by barricades, and the other crosses the railroad tracks that are often blocked by trains.

I have tried to make a career out of addressing the areas of most need at the intersection of health and anti-racism. This took me away from the traditional doctor-patient medical care, and even from traditional public health and

community medicine. Since I had selected such an unconventional career path, I thought that I would be disdained by organized medicine.

In 2008, I attended a national convention of the National Medical Association (NMA), which represents the interests of African American physicians and their patients. I knew their history of fighting racism, which was part of the impetus for their founding in 1895, when African American physicians were excluded from the American Medical Association (AMA), limiting their training and practice opportunities. I knew that this continued until the 1970s in some counties in Southern states, where African American physicians were excluded from their county medical societies, preventing them from being able to join the AMA. But I didn't know if those in clinical practice would be interested in and supportive of environmental health and justice.

At this NMA conference, in addition to my participation in community health and public health activities, I somehow wound up attending a luncheon of obstetricians. When they asked me where I practiced obstetrics, I sheepishly admitted that I didn't practice obstetrics, but was an environmental health and environmental justice physician. To my surprise, they got very excited. They told me that they were seeing increasing rates of congenital malformations and other maladies that they thought were related to environmental exposures. They said that they did not know much about environmental health but were very interested in learning about it. They asked me what I could do to help them. I thought long and hard about this. Would I be willing to leave the grueling but spiritually rewarding work of raising the voices of grassroots needy people at the local and state level in order to echo their voices in Washington, backed by the credibility of African American physicians? Could we be as effective?

In 2010, Dr. Leonard Weather was elected as the 111th President of the National Medical Association. He was an obstetrician and gynecologist who specialized in infertility. Because of his concern about the contribution of environmental exposures to infertility, he named environmental health as one of his three top priorities and re-established a long dormant Environmental Health Task Force. Because of my interest, he named me as co-chair of the Task Force. I was thrilled with the interest and support that the NMA provided to environmental health policy that affected vulnerable populations. It became clear to me that although there were not many physicians who were knowledgeable about environmental health, there was great interest and enthusiasm; they were seeing the effects of toxic environmental exposures in their patients firsthand.

I became convinced that, as an African American physician with grassroots environmental justice experience, I had a unique opportunity and responsibility. I could bring my environmental justice and environmental health advocacy experience learned at a local level to national policy decision-making bodies by engaging NMA physicians to fight unjust and racist environmental policies. I applied for

grants and became a consultant to environmental justice organizations nationally as well as to the NMA. I started training a lot of physicians on environment and health, how to counsel their patients, how to speak out in public, and how to speak on radio and TV about environment and health. I found that many physicians had very little knowledge or interest in environmental health at first, but once I spoke with them, I was able to help them see the connections between the diseases they encountered in their patients and environmental exposures.

On the policy front, we again had several successes, although they were fewer and harder to recognize. We were effective in stopping polluting industries from misleading some civil rights groups as well as Black and Latino politicians into supporting policies that were damaging to health: for example, opposing the industry narratives that poor people want coal because it's cheaper (they don't) or that poor people need chemical flame retardants to stop the excessive rates of fires (they don't). We were told by staff people on Capitol Hill that we were effective in our meetings with members of Congress and their staff, that they talked about our visits weeks later. The Chief of Staff of a Louisiana senator stated that in his two years there, our Louisiana affiliate was the only professional organization that had talked to him on behalf of poor people. We lobbied against one bad bill that had been scheduled for a vote the following week on the basis of its detrimental effects on health. The vote was first delayed and then canceled. We were told by staff who supported our position that we influenced this decision.

In 2014, I was approached by Dr. Mona Sarfaty, a physician from George Mason University, to gauge the NMA's interest in climate and health. She wanted to test the hypothesis that climate would affect health to see if it was already happening or if physicians were expecting it to do so. We teamed up and conducted the first national physician survey on climate and health. We found that 88 percent of NMA physicians were already seeing the health effects of climate in their patients. To our surprise, tied with exacerbation of cardiac and respiratory disease, the leading health effect of climate was injury from severe weather events, which of course varies a lot from place to place. On the West Coast, it manifested as lung injury from smoke inhalation from wildfires. In the Northeast, it was an increase in flood and snow-related injuries. In addition, almost 90 percent of NMA doctors said that they wanted more education on climate and health, and a full one-third of respondents said they wanted to be engaged in community education and policy advocacy. About 80 percent said that it was relevant to patient care, and that they wanted the National Medical Association to engage more in climate and health.

I have found that professional associations, such as medical societies, are important to witnessing professionals. One emerging trend in medical practice is that more physicians are working for hospitals or insurance companies rather than engaging in independent private practice. This trend limits their ability to

speak out publicly without risk to their jobs and livelihood. However, being involved in a professional organization, such as the National Medical Association or another medical society, allows them to speak out as a group, without jeopardizing their hospital privileges. In addition, if views have gone through the vetting process and are condoned by established professional societies, they are, by definition, mainstream views and are credible. So medical societies and other professional organizations are important vehicles for the expression and acceptance of responses to new challenges.

It also turns out that medical societies are important for motivating action on climate change. The George Mason University Center for Climate Change Communication found through their research that physicians and nurses are some of the most trusted voices on climate change, and that they have the ability to change opinions and motivate climate action through educating the public and policy-makers on the effects of climate change from a health perspective. George Mason University put these research results into practice by starting the Medical Society Consortium on Climate and Health in 2016. In four years, it has increased from eight member medical societies to twenty-nine member medical societies, representing more than 60 percent of all physicians in the United States. In addition, the Consortium has more than fifty affiliate health organizations and a dozen state affiliates. I am now the Director of State Affairs for the Consortium. We train health professionals to speak out through op-eds, radio/TV, and social media about the health effects of climate change, the need to adapt to and develop resilience against climate change and its health effects, and the health and health equity benefits of climate mitigation through reduction of fossil fuel use. We encourage the adaptation of climate policies that reduce racial disparities. We identify clinicians who are willing to be out front, to be witnessing professionals.

My experience of racism and my commitment to medicine as a child have served to motivate me toward dedicating my life to fighting individual, institutional, and structural racism in health, and toward the achievement of health equity. My ability to live in several cultures and institutions but not be tethered to any one of them has provided me with the perspective to imagine a world that is different and better; to use my professional knowledge, experience, and privileges to identify the institutional change that is needed; and to connect with those who can help me make that world a reality.

I have faced many challenges, made many sacrifices, and achieved many successes as well as failures. I have made my own path to address pressing, unmet needs that I have identified throughout my career. There are many more challenges ahead. As a witnessing professional with a national viewpoint, I am heartened by the depth and breadth of the recent awakening of people of all races and ethnic groups in the United States and internationally to racial injustice in the aftermath

of the indefensible death of George Floyd at the hands of police. This awakening is not only to criminal justice policies and practices, but also to health policies, with the disproportionate impact of the COVID-19 pandemic, to environmental policies, to climate policies, and throughout the institutions that govern our lives. As a witnessing professional, I invite you to join me and seize this moment to deepen our understanding of this parallel universe of injustice, and what is required to dismantle it. We need every voice.

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From Air Pollution to the Climate Crisis: Leaving the Comfort Zone

Patrick L. Kinney

While climate change poses existential risks to human health and welfare, the public health research community has been slow to embrace the topic. This isn't so much about a lack of interest as it is about the lack of dedicated funding to support research. An interesting contrast can be drawn with the field of air pollution and health, which has been an active and well-supported research area for almost fifty years. My own career journey started squarely in the latter setting in the 1980s, but transitioned to a major focus on climate and health starting around 2000. The journey has been punctuated with opportunities and obstacles, most of which still exist. In the meantime, a large body of evidence has grown on the health impacts of climate change, adding more urgency to the imperative for action. Institutionalization of climate and health within the federal regulatory and funding apparatus is now needed if we are to make the transition to zero carbon in ways that maximize health and equity benefits.

As a public health scientist with an interest in environmental factors affecting human health, there seem to be so many interesting problems to work on that one rarely finds the time to step back and ask, how did I get here? More personally, how did I make the transition from being a mainstream air pollution health scientist to one of the few public health researchers looking at climate change? Also, what opportunities and barriers molded my journey toward that outcome? These are questions I hadn't given much thought to before agreeing to participate in the May 2018 Witnessing Professionals and Climate Change Workshop at Princeton University.¹ I approach the questions that the conference posed from the perspective of my development as a public health scientist over a period in which the evidence for, and societal awareness of, climate change as an existential challenge grew exponentially from a very quiet beginning. Engagement by the public health field in the climate change discussion has grown proportionately, but remains surprisingly limited.

In many ways, the story of my career started in a small city in Pennsylvania. Donora is a steel town sitting low in the valley of the Monongahela River near Pittsburgh. October 27, 1948, was a foggy, smoggy Wednesday in Donora. In fact,

the air was unusually thick even for Donora. The local steel mills and zinc smelter were spewing out noxious fumes as they always did. But on that Wednesday, the weather had changed in a way that made the pollution worse. A temperature inversion had formed over the valley. An inversion acts like a lid, preventing upward movement of pollutants emitted near the ground. Meanwhile, the hills ensured that nothing could move sideways either. As a result, pollution levels started to build up. By the next day, residents began to report severe respiratory problems. They were coughing and wheezing, and calling their doctors or trying to get to the hospital. There was no relief on Thursday, nor Friday. Pollution continued to build up. The air was so thick that driving became hazardous. Finally, on Sunday night, the rain came and cleared the air. However, during those few days when the air was unusually polluted, twenty of the town's fourteen thousand residents had died. In the weeks following, another fifty people died of respiratory causes. And about half the town, around seven thousand people, complained of respiratory problems as a result of the smog.

The Donora experience caught the public and many health professionals by surprise. Until then, most people thought of pollution as a sign of economic development and progress. Sure, it was annoying and could make your eyes burn, but nobody really thought pollution could kill you. A few years later in London, in 1952, there was an even more severe air pollution disaster, brought on under similar meteorological conditions as in Donora, a temperature inversion. However, the pollution was different. In London, the culprit was coal combustion: residents and businesses in London burned coal to warm their homes and buildings. But because of the inversion, all that coal pollution got trapped over the city. And London had a much larger population than Donora, Pennsylvania. Based on an analysis of death records in London before, during, and after the episode, epidemiologists have estimated that over ten thousand people may have died from exposure to air pollution.²

Like Donora, the 1952 London smog event drew a great deal of new attention to the health risks of air pollution from both the general public and policy-makers. This led in the following decade to the first regulations to limit air pollution levels in both the United Kingdom and the United States. In the United States, the Clean Air Act of 1963 called for setting National Ambient Air Quality Standards to protect human health, including for groups most sensitive to ill effects. The Clean Air Act also created new demands for knowledge generation, information systems, air quality planning and guidance, and air monitoring data. This soon evolved into a symbiotic regulatory-science ecosystem combining regulatory agencies, affected businesses, funding agencies, and academic researchers working together to clean the air. This would have profound and long-lasting impacts on the scientific and technical communities. And it was remarkably successful. Just since 1990, hourly sulfur dioxide concentrations decreased by nearly 90 percent; since 2000, average annual PM_{2.5} (particulate matter) concentrations have dropped by nearly 40 percent.³

When I entered graduate school in 1981, this regulatory-science ecosystem for air pollution and health was well established. I quickly learned that scientists did the research to quantify health effects of air pollution, and then the Environmental Protection Agency (EPA) used those findings to periodically update air quality standards. States would clamp down on responsible local emission sources, and would also put out air sensors as part of a nationwide air monitoring network that tracked compliance with the standards. Interestingly, that same monitoring network became the key source of exposure data for the research community doing epidemiologic studies, such as a seminal study linking mortality rates to long-term particulate matter concentrations in U.S. cities.⁴

There was a lot to do. There were many questions to ask, and as a graduate student, I was eager to design studies to answer them. During my graduate training and for several years afterward in the department of environmental medicine at New York University (NYU), and later at Columbia, I helped design epidemiologic studies to answer questions like: Is ozone acutely associated with mortality? Do long-term ozone exposures lead to chronic respiratory diseases, as suggested in some animal studies? Do transportation sources such as diesel vehicles create hot spots of unhealthy air near roadways? (The answers turned out to be yes in all cases.)

After five years as a junior faculty member in an NYU department completely devoted to air pollution and health research, in 1994, I was presented with an opportunity to move to Columbia University. At NYU, I had been part of a very productive but narrowly focused air pollution research laboratory set in Sterling Forest, forty-five miles north of the George Washington Bridge, an easy fifteen-minute commute on country roads from my upstate home. As I think back on it, the idea of moving away from my comfortable niche at NYU was daunting. In fact, it took almost a year for me to finally decide to accept Columbia's offer. One of the key factors that finally pushed me over the edge was that Columbia University was in the process of forming the Earth Institute (EI), a novel effort to coordinate environmental sustainability scholarship across Columbia University. The EI's launch in 1995 was spearheaded by then Executive Vice-Provost Michael Crow, who sought to create "a community of environmental and social scientists, lawyers, policy and management analysts, health experts and engineers to collaborate across schools and disciplines."⁵ This holistic view of environmental science was inspirational, holding the promise to open new research doors.

Moving to Columbia at that time turned out to have a profoundly positive effect on my future scholarship. Joseph Graziano, my new chair and the person who recruited me, was among the senior faculty launching the EI. As soon as I moved to Columbia, I was immediately connected to a remarkably rich network of potential new colleagues. I kept working on my air pollution and health studies, but I also kept one ear open for interesting new opportunities.

A door opened early in 1999 when I was invited to a meeting at the EI to discuss joining a team to assess potential climate change impacts in the New York City (NYC) metropolitan region. This was to be one of eighteen regional components of the U.S. National Assessment of the Potential Consequences of Climate Variability and Change. Led by Cynthia Rosenzweig, senior staff at the NASA Goddard Institute for Space Studies (GISS) in NYC and the Columbia Center for Climate Systems Research, the EI team was seeking a faculty member who knew something about public health to complement a team of climate science and impact modelers. At the first meeting at the EI, I met several new colleagues, including Drew Shindell, a climate modeler at GISS. He told me about the model he used to project future climate and air pollution under a range of greenhouse gas scenarios. Drew was particularly interested in how climate change could affect ground-level ozone concentrations. Ozone was something I knew a lot about. I had been doing epidemiology studies to understand ozone health effects ever since graduate school. It seemed like it would be fairly straightforward to project future ozone-related health impacts if Drew's model could estimate what the ozone concentrations might be under future climate scenarios. I enthusiastically agreed to be part of the team. Working with two master of public health students at the Mailman School of Public Health, we developed a report on potential health impacts of climate change in the region, which was published in 2000 as part of the Metro East Coast report.⁶

This was my first research on the health effects of climate change. A key precursor for such a transition was the existence of the interdisciplinary framework of the EI that made possible the random connections that could lead to creative collaborations, like mine with Cynthia and Drew. Cynthia was key in organizing the Metro East Coast project, which was an intentionally interdisciplinary team. Climate change is so complex a challenge that it naturally called for multidisciplinary teams. In the early stages, there weren't too many people in any one discipline working on it, so the teams would have one health person, one modeler, one impact assessor, a government stakeholder, and so on. There was not yet a critical mass of people in any one discipline at the table (especially true for public health) to make it easy to stay in one's comfort zone. You were likely to be the only person from your field on the team. Thus, one was forced to reach across and learn how to talk and collaborate with the others. To take on this sort of challenging collaboration I think calls for a certain openness to taking risks, a personality that is attracted to new things. Why was I receptive to this? For one thing, there's something deeply invigorating about meeting new scientists in other fields and trying to understand what they do and how that might intersect with what you do. It's like a puzzle to solve. My doctoral training in environmental health was similarly multidisciplinary, so I was used to this. Environmental health was and is a very broad domain, unlike biology or chemistry or economics, perhaps.

As I began to research the implications that climate change could have for human health, I soon realized how little was yet known about this important topic. To be sure, there were pioneers, including Anthony McMichael, Andy Haines, Paul Epstein, Jonathan Patz, and Kristie Ebi, who had raised the alarm about potential public health risks of climate change.⁷ However, the mainstream environmental health research community had not yet engaged with the topic. The lack of research on climate and health was shocking, and a little awe-inspiring. I hadn't before had the opportunity to catch an early glimpse of a whole new discipline that was as-yet unstudied, like an unexplored wilderness. It surprised me, but also motivated me to start working in this field. For one thing, it's interesting to learn new stuff, and to be a pioneer in an uncrowded field. But more important, it was clear that climate change was going to be a huge problem for both Earth and society, and one that everybody would soon start to care about.

I began to build on that initial collaboration to expand my research on likely health impacts of climate change. The connections I had made through the EI formed an excellent foundation for an expanding network of collaborators. One of the first questions we asked was: to what extent will climate change affect future air pollution, holding everything else constant? And given those changes, what would be the health impacts? I had a special interest in ground-level ozone, which gets worse when temperatures increase. Ozone of course is desirable to have in the upper layers of our atmosphere because it's effective at blocking health-damaging UV radiation. But you don't want to breathe ozone, a strong oxidant gas that has been associated with a wide range of adverse health effects, including premature deaths. Ground-level ozone is formed through reactions between nitrogen dioxide gas and volatile organic compounds in the atmosphere, in the presence of sunlight. Ozone formation is greater at higher temperatures, and ozone is the main component of summer smog episodes.

By early 2000, when the EPA issued a request for applications for research projects to quantify health impacts of climate change, I was ready to jump in. We proposed and were soon funded to model climate in the 2020s, 2050s, and 2080s, and analyze what that might mean for ozone and fine particle pollution.⁸ We were able to show that increasing health risks might occur in the NYC metro region and throughout the Eastern United States.⁹ And that knowledge – early knowledge that we began to generate – had some impact; for example, in supporting the EPA's endangerment finding of 2009. In order to regulate carbon dioxide as an air pollutant, the EPA needed to make the case that carbon dioxide and related greenhouse pollutants have adverse health effects. But unlike ozone or fine particles, most greenhouse gases (GHGs) don't directly harm health at ambient concentrations. What the EPA was able to show, however, was that GHGs, by driving climate change, could result in adverse health effects from heat waves, worsening air pollution, and other pathways. Our findings on climate-induced increases in

ozone-related mortality were part of the rather sparse set of evidence available for the EPA to bolster its arguments in support of the endangerment finding. Witnessing this direct use of our research for policy development reinforced my commitment to continue working in this field. Even though the U.S. climate and health research enterprise remained quite limited at that point, it was gratifying to see that the findings that had emerged to date were directly useful for policy-making. Making the link to adverse health impacts was a critical piece of evidence that the EPA needed. In addition to the EPA regulatory developments, findings on public health impacts were used in periodic climate impact assessment reports, including those of the U.S. Global Change Research Program.¹⁰

The transition I made from air pollution epidemiology to climate health impacts research was relatively easy on the technical front. It turned out that the research tools needed to quantify impacts of climate on health are the same as those used to study the effects of air pollution on health. These include epidemiology and biostatistics (used to estimate exposure-response relationships using empirical data) and risk assessment (used to explore potential health impacts or benefits of hypothetical scenarios of change). To be sure, climate change does present unique methodological challenges to epidemiology, especially related to its long-term gradual nature (something that epidemiology is not well suited to). However, for the most part, there aren't significant technical barriers to public health scientists entering the field.

The challenge had more to do with the lack of a research “ecosystem” of the sort we had for air pollution. Missing was a cadre of like-minded colleagues, supportive departments, reliable federal funding agencies, receptive government regulators, and so on. Most prominent among these as a barrier for public health researchers has been the lack of federal research funding.¹¹ Research on the health effects of climate change doesn't fit easily within the National Institutes of Health (NIH), where molecular and mechanistic biological questions are of paramount funding interest. Nor does it fit well at the National Science Foundation, where health effects are of limited interest. Two key federal agencies, the Centers for Disease Control and Prevention and the EPA, historically played a central role in filling this gap by supporting work at the intersection of climate change and health. However, both agencies have seen their climate and health research operations eviscerated under twelve years of oil-industry-infused presidential leadership since 2000, assisted by powerful climate deniers in Congress. The result is a lost generation of critical scientific knowledge and expertise, which is now urgently needed to develop cost-effective policies that both build health resilience to worsening climate extremes and also maximize health and social equity cobenefits of rapid decarbonization strategies. To catch up will require a massive, ongoing federal effort to generate the needed knowledge.

The gap in federal research funding has hobbled progress in this field and presented a substantial entry barrier to public health researchers who might otherwise be highly motivated to generate urgently needed new knowledge. Most public health schools reside in medical centers and operate on a soft-money model, where the bulk of one's salary must be funded from outside grants, ideally from the federal government with full overhead. If the federal government isn't funding research on the health effects of climate change, too few public health researchers can enter the field, in spite of the growing evidence of increasingly severe storms and heat waves.

On the positive side, I've witnessed over the past decade a slow but steady transition toward climate research among a small number of open-minded, well-established senior investigators who have reached points in their careers where they have the freedom to shift away from what they've been doing to focus on the crisis of climate change. At the other end of the career ladder, there has been an influx of young predoctoral and postdoctoral climate investigators. What is missing so far are the midlevel, highly productive academic researchers whose career advancement depends on a track record of NIH grants.

After my initial EPA STAR grant in 2000, much of my scholarly work on climate and health has been carried out without dedicated funding. While that has made things a little challenging, the work has continued apace due largely to a steady influx of highly motivated and extremely productive graduate students and postdocs. For many years running, many of the very best students who applied to our departmental Ph.D. program at Columbia wanted to study climate and health. And we had funding to support both grad students and postdocs. Our trainees made important discoveries about climate change and ozone, heat, pollen, and other factors.¹² Along the way, we created at Columbia the first dedicated program on climate and health in the country, including a master of public health certificate. Of course, the kinds of research studies that can be done with student labor are limited to those where readily available data sets could be analyzed, or where small-scale field studies could be carried out with small supply budgets and lots of student footwork. That has limited the scope of work that I have been able to do. Also, given the bleak funding landscape, it remains uncertain whether students who graduate with training in climate and health can expect to find jobs where they will be able to apply their unique knowledge. The gap in institutionalization and political defunding conspire to create dangerous currents against which climate and health practitioners will need to swim.

Still, we're seeing more and more students wanting to work in climate and health now, as the reality of climate change becomes ever more apparent. We've seen so much evidence of change around us, and the lack of global or federal action in the face of those changes has been deeply alarming to young people who will inherit our world.

Publishing scientific papers and working to inform policy developments are important aspects of being an effective witness to the climate change crisis. Another way we can witness is by being better at communicating our knowledge outside the academy. Most public health scientists publish research results in papers in scientific journals. We go to conferences among our peers, and we talk about our research with peers. Journals and scientific conferences have seen a steady rise in climate and health research related studies. Those findings are sometimes picked up and used by regulators and policy-makers. But for an issue of the magnitude of climate change, the audience we need to reach is much larger. Health concerns can be a big motivator of public support for environmental regulations. Though we haven't been trained to do it, there is an urgent need for health scientists to communicate more directly with the public about the health effects of climate change. Climate change remains a politically divisive topic, partly due to the lack of knowledge among the general public about the many direct connections with human health. Survey research has shown that attitudes toward alternative energy sources among Americans are informed by environmental health risks as well as cost considerations.¹³

While climate change itself remains a politically divisive topic, improved public knowledge about the health implications of our energy choices could help lead us toward strategies that are good for both health and the planet. Filling the knowledge gap calls for different kinds of communication tools than most researchers have been trained for. Researchers will increasingly need to make the effort to tell the story of climate and health in words that convey greater feeling and meaning to more people.

ABOUT THE AUTHOR

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ENDNOTES

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Climate in the Boardroom : Struggling to Reconcile Business as Usual & the End of the World as We Know It

Rebecca Henderson

How does one witness to businesspeople about climate change? Climate change is a problem for the collective and the long term, whereas business often requires a ruthless focus on the individual and the quarter. Climate change is an ethical catastrophe whose solution almost certainly requires a profoundly moral response, but talk of morality in the boardroom is often regarded with profound suspicion. Reconciling these tensions has forced me to navigate between worlds in an ongoing attempt to persuade businesspeople that solving climate change is both an economic and a moral necessity, and that the purpose of business is not only to make money but also to support the institutions that will enable us to build a sustainable world. This has not always been easy.

For many years I was the Eastman Kodak Professor at the Sloan School of Management, MIT's business school. It was a coincidence, but a deeply ironic one, since my research explored the drivers of innovation, focusing particularly on why it was that hugely successful firms like Kodak have so much difficulty responding to discontinuous change. I spent years working with firms like Nokia and General Motors – and indeed even with Kodak – trying to persuade them that embracing change was both central to their survival and an opportunity for profitable growth, while simultaneously writing academic papers about what made it so hard for them to take my advice.

I have always been a passionate hiker and an enthusiastic tree hugger, but for the first fifteen years of my career, it didn't occur to me to bring my passions or my politics to work. I was one of the first women tenured in my department, and I learned early and often that achieving professional success was about mastering the numbers and playing the game. I had a bachelor's degree in engineering from MIT and a doctorate in economics from Harvard. I didn't "do" enthusiasm – or ethics or emotion – at work. I did expertize.

Then a movie changed my life. In 2006 I saw Al Gore's *An Inconvenient Truth*. Gore's message fell on prepared soil – my brother, a freelance environmentalist,

had been sending me climate change related material for some time – but the film shocked me out of my comfortable assumption that someone else would take care of things. I sent an email to everyone on my contact list telling them that they had to see it and began teaching a course on sustainable business.

In the beginning, I thought of climate change as just another innovation problem: a “Kodak moment” for the planet. It was obviously necessary to decarbonize the global economy, and it was clear that many of the firms who pioneered the transition would do very well. While I was convinced that we would never tackle climate change successfully without appropriately designed and implemented public policy, I believed – and continue to believe – that persuading firms to embrace the reality of climate change and to invest in building carbon-free solutions not only helps drive the kind of innovation we need to decarbonize the world, but also greatly increases the odds of getting appropriate policy enacted.

I started working with Enel, an Italian power company that at the time was building roughly one renewable power plant a week. I became a consultant to Unilever, one of the world’s largest consumer goods companies, where Paul Polman, the new CEO, had just announced plans to halve the company’s environmental footprint while doubling its revenues. I worked with Walmart, who the year before the release of *An Inconvenient Truth* had promised to transition to 100 percent sustainable energy, to write a case about decarbonizing their supply chain. I partnered with the CEO of one of the United States’ largest electrical utility companies to try to persuade his senior team that the world was about to change forever.

It was fascinating. It is now close to conventional wisdom that there is money to be made in addressing climate change, but at the time, it was a new and surprising idea. I learned two things. The first was that there was money lying on the floor. Most firms had never paid serious attention to energy costs or greenhouse gas emissions, since energy was almost free (for the average firm, energy makes up only about 3 percent of their operating costs) and emitting greenhouse gases was not only entirely legal but also completely ubiquitous. It turned out that when firms started paying attention, there were all kinds of ways to reduce emissions and to make money while doing so. Walmart, for example, reengineered its trucking fleet to be more efficient and saved more than a billion dollars a year. Unilever’s efforts to become more sustainable led it to become one of the most desirable employers in the world, and its “purpose driven” or socially orientated brands – such as Dove, Life Buoy, and Vaseline – started to grow much faster than its more conventionally managed brands.

The second was that the firms pursuing this kind of strategy almost never claimed that they were doing so because climate change posed a catastrophic risk to the future of civilization and reducing emissions was simply the right thing to do. Instead, they stressed – and stressed again – that their investments

were all about growing the bottom line. They talked about the need to respond to risk and to shifts in consumer preferences, and about the potential for technological breakthroughs. They showed financial projections and reassured their investors that they were simply looking to make money. Every successful manager had learned the lesson that I learned to get tenure: don't "do" enthusiasm – or ethics or emotion – at work. Do expertize.

But after hours and out of sight, nearly everyone I spoke to was at least as passionate about solving climate change as I was. In the corridor after the meeting, or over a beer at the end of the day, they talked about their responsibility to their children and the strength and courage it would require to remake the economy. In private, they used terms like "existential risk" and "moral imperative" and harangued their colleagues about their firm's responsibility to the world. But they hardly ever spoke this way in public. One CEO I knew had turned around his entire firm by building a common sense of shared mission to the community and the need to contribute to the public good. There wasn't a single word about it in his annual report.

To be a businessperson is, by definition, to climb into a box whose walls are defined by the bottom line. Only those who can reliably deliver profits are likely to survive in today's ruthlessly competitive world. In the words of an Italian divisional manager whom I pressed on this point some years ago: "You don't understand. I wake up with my number. I go to sleep with my number. I take my number on vacation." Every successful manager learns to make their number – whether it's the quarterly revenue goal or the product-level profit target – lest they face a career-ending reckoning. Yet we must tackle climate change if the economy – not to mention our planet and our society – are to thrive. We must think about the long term and the collective good. We must talk about what is right.

For the last ten years, I have devoted my career to trying to reconcile these perspectives: to acknowledging the very real pressures that businesspeople are under while simultaneously attempting to persuade them to bring their profoundly moral convictions about the need to act against climate change into the mainstream of their professional lives.

I tell them that it is not a question of focusing on either profits or the common good. I try to persuade them that the purpose of business is not only to build thriving and prosperous enterprises, but also to help build a successful, inclusive society on a healthy planet. I argue – often, and in public – that in addition to the strong economic case for tackling climate change, there is a strong moral case: that the commitments to prosperity and freedom that are the deepest normative commitments of free-market capitalism require that business leaders bring their passionate concern for the future of the world into the heart of their work. Talking about the bottom line should not preclude having a conversation about ethics. Rather, it should require it.

It is easy to assume that running a business is a mechanical affair: that firms simply weigh up the costs and benefits of any particular course of action and decide to pursue the most profitable option. But in reality, any important decision is fraught with uncertainty, and managers make choices all the time as to where to focus their attention, how strongly to weigh different pieces of information, and what to expect from the future. This is particularly the case when firms are considering tackling climate change.

Take, for example, the current turmoil in the automotive industry. Sales of electric vehicles are currently only a small fraction of total automobile sales, but they are growing very fast. Every major automobile company believes that eventually the entire automobile fleet will be electric. The question is only (!) how and when. No one yet knows quite what consumers will want from electric vehicles. Will they demand fully autonomous vehicles owned and controlled by others, so they can simply summon a car to their door when they need it? Will car users welcome “cars” that are actually moving gyms or offices? Or will they want exactly what they have now, just with an electric powertrain? No one knows when the technologies necessary to realize any of these visions will fully mature, how long it will take to decarbonize the power grid, or when storage and charging technology will be sufficiently far advanced that using an electric vehicle will be merely cleaner and quieter than using a conventional car. It is one thing to agree that there is a long-term opportunity in electric vehicles, but in the face of this kind of uncertainty, it’s quite a different proposition to decide to invest billions of dollars today in order to take advantage of it.

It is in these moments of uncertainty that I have found the opportunity for witnessing. I have spent much of the last ten years alerting managers (and MBA students) to the opportunities that are out there, to supporting them in thinking carefully about how the future might be different, and to trying to persuade them that when there is real uncertainty, it is not only appropriate but absolutely necessary that they bring their sense of what is “right” to bear.

A few years ago, for example, I was invited by the CEO of a major power company – I’ll call him Jim – to lead a day-long retreat for his senior team. He had made no secret of his beliefs, writing and talking so passionately about the need to address climate change that his team had begun to suspect that he was more interested in his legacy than in the health of the business. He asked me to help him persuade the group that it made sense to invest in renewable energy. So, I became an interpreter. I doubled down on the business case for the investment – which was strong but implied taking on a fair degree of organizational and strategic risk – and I stressed the number of other firms that were finding profitable ways to embrace renewables. But I also encouraged Jim to talk about the moral case for making the investments, and the way that doing so was in line with the deepest values of the organization. Once it was clear that Jim’s vision was compatible with the language

of business, the team became quite enthusiastic about the idea and they became something of a leader in the space.

For thirty years, my scholarly research has explored the strategic and organizational factors that make it possible for some firms to embrace the future while others falter and die. I have learned that, as one might expect, building the economic case for change is critical. So is managing the organizational dynamics of running the old business while building the new. But again and again, it seemed to me, the firms that were able to change found the courage, the mutual trust, and the sheer persistence required to do so in their embrace of a shared purpose that was about more than making money.

I once worked with a pharmaceutical company that was exploring pioneering the use of diagnostic tests in association with their drugs, so that doctors could be sure a particular patient would respond to a particular drug. The head of marketing vigorously objected to the idea, pointing out that it would significantly risk overall sales. “I know,” the CEO replied, “but would you rather go on selling drugs that don’t work to sick people?” In reframing the decision as one that was about both economics and ethics, he was able to take the entire firm through a difficult and risky transition.

I write papers about this firm and others like them, exploring the role of “relational contracts” – a particular form of trust – in increasing productivity and creativity and suggesting that one of the best ways to maximize profits is to care about more than maximizing profits. I spend more and more time thinking and writing about ethics. There is a deep contradiction at the heart of the injunction to maximize shareholder value. For years, business schools told their students that the social responsibility of management was to maximize profits; that to do anything else was to betray their responsibility to their investors and to interfere with the operation of the free market, jeopardizing the prosperity that the market is designed to produce. If firms have a moral duty to maximize shareholder value, it would seem that they have a duty to do *everything* they can to raise profits, including, for example, supporting active climate denial and lobbying hard to forestall climate regulation.

But free markets only maximize prosperity when “externalities” such as climate change are properly priced. Every coal plant in the world causes much more damage – measured in terms of the effects of their emissions on both health and the climate – than the social value they create. If firms can dump greenhouse gas emissions into the atmosphere for free, there is no guarantee that the operations of the market will maximize social welfare. From this perspective, businesspeople have a duty to ensure that carbon is properly priced, while doing all they can to help decarbonize the world’s economy. This implies, for example, that it can’t be the case that firms have a moral duty to do all they can to flood the political system with money in the service of delaying carbon regulation.

As I've grappled with this issue, I have increasingly focused my research on the troubled intersection between business and politics, trying to understand those historical moments in which the private sector has played a positive role in building strong, democratic institutions, while simultaneously working with practitioners to explore what such a movement might look like today.

It has been a wild ride. There were only twenty-eight students in the first meeting of "Reinventing Capitalism," the class I developed to support MBA students in thinking about climate change. Last semester, there were nearly three hundred. Together with a group of passionate and inspiring colleagues – many of whom have been at this for far longer than I have – I've seen both business and business school education begin to change in profound and hopeful ways. My professional life is richer and more interesting than it has ever been.

I am still sometimes tempted to downplay the fact that climate change is an existential crisis, requiring both a radical rethinking of the moral purpose of business and the willingness to act on our values in the face of doubt and hostility. Sometimes when I'm standing on a stage in full regalia (stylish black jacket, colorful scarf, the highest heels I can manage) in front of a roomful of powerful people, I'm tempted to tell them that they should try to solve the world's problems simply because it will make them all more money. It has the great virtue of being both true and what they want to hear. I worry that if I start talking about "values" and "purpose," they will write me off as a simpering female who doesn't understand the hard realities of life in the business world.

But I know that simply running the numbers will never get us where we need to go. I know that genuine progress requires a commitment to doing the right thing, and to squishy concepts like purpose and meaning. Sometimes I envy those who can ignore what is happening to our only planet, confidently claiming that it's not their job to think about it. But alongside the waves of profound despair that visit me regularly, there is a fierce joy in insisting that change is possible. There are many worse ways to spend one's time than trying to shift the entire ethical framing of capitalism, particularly if you are one of thousands of people with the same idea. A CEO with whom I worked recently described to me a conversation he'd had with two of his largest investors:

I gave them the usual spiel about how our operating margins were up and how the investments we'd been making for growth were paying off, and they asked me the usual questions. Then I asked them if they thought climate change was real and, if it was, if the world's governments were going to fix it. Yes, they said – and no, governments weren't going to fix it. There was a pause. I asked them if they had children. They did. So I said, "If government isn't going to fix it, who will?" There was another pause. Then we started a real conversation.

Change is slow – but it is coming.

ABOUT THE AUTHOR

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Task Force Climate Change: A Patron Saint of Lost Causes, or Just Ahead of Its Time?

David W. Titley

This essay explores the origins of the 2009 U.S. Navy Task Force Climate Change (TFCC) from the perspective of its founder and initial director. The director's background is described briefly, along with events and actions of Navy leadership that led to creating the TFCC. The essay states five lessons learned within the context of setting the direction and tone for change in a large organization and examines five areas in which the TFCC arguably has made a positive difference to the U.S. Navy. The essay provides an overview of U.S. Navy and national climate-related actions after the author's tenure as director of the TFCC, and concludes by addressing climate change risks within the context of current efforts to understand and manage adverse impacts from the COVID-19 virus.

All I ever wanted to do was to forecast the weather. I'm not sure exactly why or where that interest came from; my parents told me a tornado went through our backyard when I was two years old, although I have no recollection of that event. I grew up in an old manufacturing city in upstate New York; maybe the brutal winters with eighty inches of snow each year had something to do with it. Whatever the reason, by the time I was in first grade, my six-year-old self knew I was going to work in weather-related fields for the rest of my life, even if I really didn't know what that meant at the time.

I attended Penn State University for my undergraduate studies, which was and still is a magnet for teenaged kids with a passion for weather. Their undergraduate meteorology program has been leading the nation for many decades. Unfortunately, that meant paying out-of-state tuition, something that really wasn't within reach for our family. In the search for how to pay for college, I stumbled upon the Reserve Officers' Training Corps (ROTC), a recruiting and commissioning program used by the military services to bring young officers into their ranks. The Air Force and Navy each had their respective weather programs, so I applied to both services. The Air Force said "no," the Navy said "yes," and so at seventeen years of age, I joined the U.S. Navy as a midshipman.

While my initial goal was to immediately enter the Navy's weather corps (known as oceanography special duty officers), the Navy had other plans for me. Rather, I was sent to sea on an old guided missile destroyer as a regular line officer to "drive ships." Although I was intensely disappointed, having waited my entire life to be a meteorologist, it turned out to be the best career move possible. There is no better way to understand your future customer or client than to be one. Additionally, you build a lot of credibility within the ranks of naval officers by becoming qualified in one of the core areas of the Navy: driving ships, flying aircraft, or operating submarines. I was learning a lot about institutional culture and how to talk about subjects that, while important, may be seen as peripheral to the audience.

For nearly thirty years, I worked as a naval officer specializing in oceanography and meteorology. Much of my time was spent communicating weather impacts to the operators: those who were in charge of ships, aircraft, submarines, or special operations. Nearly a decade of my time was spent at sea, where you get firsthand and immediate feedback on your weather forecasts and recommendations! Along the way, the Navy sent me to the Naval Postgraduate School to earn both a master's and a doctorate degree in meteorology. I was also able to work for the secretary of Defense's internal long-term think tank, an experience that taught me a lot about competitive strategies and net assessments. In 2004, I assumed command of the Fleet Numerical Meteorology and Oceanography Center. Shortly after arriving, I hosted a workshop titled "Climate Variability and Change in Asia: Implications for Regional Stability." The workshop was cosponsored by the National Academy of Sciences (NAS) and the Department of Defense's (DOD) Office of Net Assessment. Unfortunately, there was neither funding (nor interest) for any follow-up work and the notes were soon set aside.

In 2007, figurative lightning struck, and I was fortunate enough to be selected for the rank of admiral. My first job as an admiral was to run the operational component of Naval meteorology and oceanography; most of the broader ocean and weather policy and budget decisions were made by the oceanographer of the Navy and the Navy's headquarters staff in the Pentagon. However, events were happening that year that would get the Navy's attention and, ultimately, raise the institutional awareness of a changing climate.

In the autumn of 2007, the amount of Arctic sea ice precipitously collapsed. Since the Cold War ended, the Navy had decreased its interest – along with its operations and research – in the Arctic, but submarines still transit through or operate in that region and some of our closest allies continue to operate in the High North. As often happens with a surprising external event, lots of people gave lots of unsolicited advice and recommendations to the Navy and its senior leaders. And as is also common with large organizations, it took a while for the Navy

to respond, and when it did, it appointed someone to study the matter and make recommendations.

This is how, in the spring of 2009, while going about my daily operational job, I received a phone call from Admiral Gary Roughead, the Chief of Naval Operations (CNO). The CNO is the admiral in charge of the entire U.S. Navy, and he asked me to come up to the Pentagon, assume the duties as oceanographer and navigator of the Navy, assess the issues going on with the Arctic in a changing climate, and give recommendations as to what, if anything, the Navy should do. In the military culture, when you are “asked” to do something by someone senior to you in your chain of command, the correct response is “aye aye sir/ma’am,” and so my family and I moved shortly thereafter from Mississippi to Washington, D.C., and I began work at the Pentagon. In May 2009, two weeks after moving to D.C., I was standing in front of a meeting of the CNO, his deputy, and his most senior staff, recommending what actions the Navy should take in reaction to the sudden changes in the Arctic maritime environment.

At first – or even second – glance, it’s doubtful many would have picked me to lead what turned out to be a multiyear Navy effort to better understand the impacts of climate change on naval and defense operations. I did not have a background in climate science and was not employed by the Navy to do research. That one-day climate and national security meeting I hosted five years prior in Monterey, California, never appeared on anyone’s radar. My Ph.D. research had been focused on understanding why some typhoons strengthened rapidly and others did not, hardly the stuff of rising temperatures, melting ice, or expanding oceans. I had not paid a lot of attention to the discussions surrounding climate change, as there were more than enough challenges in operationally observing, predicting, and understanding the impacts and opportunities of the weather and ocean environments on tactical and operational scales of time and space. I would have to say I was an agnostic on climate science, or at least how climate science was often portrayed: it was not in my core area of expertise and much of the field seemed to be co-opted by environmentalists, with their emphasis on the plight of charismatic megafauna, usually thousands of kilometers away from where the people they were communicating with lived.

One of the things I enjoyed so much about my career in the Navy was the wide diversity of jobs, problems, and opportunities it presented. Every two to three years, you were sent to do a different job, to work for a different boss, in a different environment, and, usually, in a different organizational component. So, when the opportunity came along to examine the changes in the Arctic and what it meant, I was happy to do so, and set about doing it in a methodical way.

Two of the things I do when tackling a new challenge are: 1) attempt to ascertain what is ground truth, and to what level of confidence do we understand these

facts; and 2) find the truly smart people in the field, talk to them, ask them questions, figure out the strengths and weaknesses of the arguments, and ramp up my own understanding as quickly as possible. So that's what I did. In the two weeks I had to prepare, I flew out to the Applied Physics Lab at the University of Washington and had intensive sessions with the scientists at their Polar Science Center (PSC). I learned that although the Navy had mostly divested from the Arctic, the PSC "kept the (Arctic) flame burning." Their scientists were as knowledgeable about conditions in the Arctic, and what was forcing the changes, as anyone in the world. I researched the counterarguments to global warming, either that it was not happening or that recently observed changes had little to do with human activity, and found those arguments fell apart in the face of overwhelming evidence: the evidence based on physical theory that we have understood for over 150 years; evidence from a wide variety of independent observations; and evidence from multiple climate models that, at their core, are based on the same physics that allow us to successfully predict individual routine or extreme weather events many days in advance.

I was fortunate to not have much intellectual baggage on this subject. The Navy, for all its faults and flaws, is a technocratic organization that, for the most part, will consider evidence if it is framed and communicated in a way that is understandable to smart but nonspecialized leadership. Years at sea and a history of warfare have taught the sea service that you ignore documented facts and trends at your peril, as your adversary may well use that knowledge to seek advantage in the next round of combat or influence on the sea. If there was unease on the Navy's part, it was knowingly engaging on an issue that, for reasons completely unrelated to the science or facts, had become increasingly partisan by 2009. By and large, the Pentagon and the military services work hard to avoid partisanship or even the appearance thereof.

What did I tell the Navy's leadership back in May 2009? I told them that the changes in the Arctic were a challenge, not a crisis, but if we ignored the changes, it would become a crisis for our Navy. I also told them the changes in the Arctic were the harbingers of much larger changes and recommended creating a U.S. Navy Task Force Climate Change (TFCC) to examine future impacts and recommend a way ahead. The Navy agreed and on May 15, 2009, initiated the TFCC, with a near-term emphasis on the Arctic. The CNO gave me arguably the best set of orders I could ever have hoped for: "Show leadership on this [climate change] issue at the national and international level."

Of course, nothing in a big organization, or the real world, happens in a vacuum. The Pentagon, spurred in large part by a 2007 CNA (formerly Center for Naval Analysis) report on climate change and national security, and bipartisan encouragement from the U.S. Senate, was thinking about how to incorporate climate issues into its upcoming strategic review, the so-called Quadrennial Defense

Review (or QDR), due in 2010.¹ Simultaneously, the NAS was working on a report for the Navy examining the national security implications of climate change that would be released in 2011.² These events provided momentum and “top-cover” within the Department of Defense for the Navy to confront openly the risks and challenges of a changing environment.

With the luxury of a decade’s worth of hindsight, I can say the climate-related QDR language of 2010 was the most appropriate for that time. It highlighted the inextricable links between our global energy choices and the rate and magnitude of future climate change. The QDR correctly stated that while climate change was unlikely to be the sole cause or driver of a future conflict, it had significant potential to (in my words) “make bad things worse.” The QDR rightly highlighted the risks to defense infrastructure in a warming, wetter world with rising sea levels. The QDR, unfortunately, did not anticipate the lack of action we would take to address these risks over the coming decade.

For the next three years, while on active duty, I had the opportunity to both learn and talk about the impacts of climate change on the military and specifically on the Navy. The lessons learned will be familiar to anyone tasked with driving change into their organization.

Understand the culture of the organization to which you are trying to communicate. The U.S. military is a conservative but pragmatic culture that believes it’s based on a meritocracy. How much that is true is best left for others to decide, but that is the self-talk in the Building (“the Building” is how many in the military describe not only the physical structure of the Pentagon, but the culture of the DOD). The military is a huge consumer of science and technology, but paradoxically does not think of itself as a science organization.

In the late 1990s, I was the fleet oceanographer for the U.S. Navy’s Seventh Fleet, the organizational unit responsible for naval operations in the western Pacific and Indian Oceans. One of my daily tasks was to give our three-star commander a quick weather update sometime between 6 and 7 a.m. each morning. While ostensibly about weather, it was really about our operations over the next few days, and what significant issues or impacts the commander should have on his scope. While I could have talked exclusively about the weather, the Fleet units of the Navy are operational entities, not science organizations. Their culture values operational excellence, so framing weather discussions in that construct made my briefings much more valuable and increased my credibility to the staff. That was invaluable because, when weather really was the primary issue of the day, people would not only listen to me, but would also oftentimes approve my recommendations on how to manage that risk.

Given these realities, I would never lead a Pentagon briefing with a discussion of greenhouse gasses or the Keeling curve, but rather would talk about the impacts

of a changing Arctic, rising sea levels, or effects on specific bases. The most frequent questions I received were “Is this really going to be bad?”; “When will this happen?”; “How sure are you?”; and “What’s this going to cost?” The interests and questions of that audience would dictate how much (if any) of the science behind climate change I would discuss.

Talk about what interests your audience, not you; talk in their language, not yours. Successful briefs in the Pentagon are simple: they tell a story; they tell someone what the risk is, what the mitigation strategies are, when we need to implement them, and how much the remedy will cost. The brief needs to be grounded in analysis and intellectual rigor, and the briefer needs to be familiar with the underlying science, engineering, intelligence, and so on that supports the discussion. But delving immediately into the details – or science – is rarely a recipe for success.

I saw this firsthand when I was able to successfully argue for several million dollars in additional funds to recapitalize the U.S. Navy’s weather modelling capability. Several of my predecessors had tried to do this without success. They were armed with science facts, dozens of graphs showing different levels of weather model skill, studies from highly paid outside analysts, all to no avail. I took a different tack: Our current generation of weather model had its genesis thirty years ago. I told my boss at the time who controlled the funding that this was really no different than why the Navy always needs to be building ships. Naval ships have about a thirty-year life expectancy, and I told him that our model had been around for thirty years and had had many upgrades, but at some point, you just need to build a new one. He agreed. The smartest thing I did then was to take all my slides and analyses off the table, put them back in a folder, thank him, and leave his office. The entire meeting lasted five minutes.

The primary interest in the military services and the DOD is ensuring our forces, both today and tomorrow, can counter any threats posed by a potential adversary, and that we can do that in the operating environment (or battlespace) of tomorrow. If the physical battlespace is changing, then we need to change as well. Having said that, an understanding of this science and, frankly, the externally driven disinformation campaigns surrounding climate change, was critical. Some people genuinely wanted to understand, while others had significant misconceptions about our changing climate and its anthropogenic forcing. Being able to explain the science using stories, plain-language terms, analogies, and even defense-relevant jargon was an asset.

The messenger matters. Although we would like to believe that in a diverse and inclusive world, it does not matter who is delivering the message, in the real world, that’s not the case. Wearing the uniform of a naval officer, being selected as an admiral, and being qualified in two separate warfare communities gave me credibility when talking to other senior personnel in the DOD or Navy, even though there are many climate scientists who have a much deeper understanding of various as-

pects of climate change. Tribal affiliations matter, and the military is no different than any other part of society in that regard.

Sometimes appearances and perceptions are just as important as reality. During the Paris Agreement negotiations, Senator Ted Cruz (at the time a presidential candidate) held a U.S. Senate hearing on climate change (“Data or Dogma”). Of the five witnesses, I was the only mainstream scientist. But rather than play the role of a scientist, I thought it was important to also portray my role as a retired senior naval officer. Arguably, one of the most important things I did in the hours preceding the hearing was to get a fresh haircut!³

Even when our minds know we should plan ahead, it’s extraordinarily difficult to change. There is an entire body of literature examining the incentives for, and barriers to, a military organization changing itself. My personal experience was that most often, change was either driven by senior leadership, or it came in response to a threat or challenge that now appeared to be near-term.

It was a late Friday winter’s evening in the Pentagon, and I had one briefing left. It was to a four-star admiral who had a no-nonsense reputation, to put it kindly. It did not help that his aide informed me he was suffering from the flu and really needed to go home, so his mood was probably not the best. My brief was about China’s increasing capability to threaten our aircraft carriers. There really wasn’t much new here – we had been studying this particular threat for several years. About five minutes into the brief, the Admiral stopped me and wanted to go over the timelines of when China could deploy this threat. He said, “this is now inside our budget cycle; that changes everything.” The threat had moved from one of the nearly infinite, “this could happen sometime in the future” issues to something that now should be countered within the current five-year budget cycle.

The Pentagon probably has a better reputation for long-range planning than it should. While no one in the Building intentionally designs a force to fight the last war, divining the future, like predictions, is hard (with apologies to physicist Niels Bohr). What may be less recognized is the huge range of predictability across future events, dependent upon spatial and temporal scales, and root causes. At one end of the predictability scale are astronomical and tidal events, described well by Newtonian physics. Although they are predictions, they are treated as simple facts. Many of the threats the Pentagon addresses are on the other end of the spectrum: a complex mix of economics, technology, sociology, and individual ego, leading to very low predictability, certainly in a deterministic sense. I argued that climate change and climate risks are somewhere in the middle of this spectrum. We have a much higher degree of predictability of the earth’s climate thirty, fifty, or seventy-five years in the future than we do about the state of our great power rivals, violent extremism, or even how known technologies may be combined and weaponized. We, of course, do not have perfect knowledge of what the climate will be like decades from now, and there are important aspects of climate change

that have low predictability. Communicating what we do know, rather than all the things we don't know, while at the same time being up front with the limits of our knowledge, and doing this in a way that makes sense to busy people with broad portfolios was, and will always be, a challenge.

The challenges of the budget and allocating money are nearly as great as those of managing the future. The DOD has a rolling five-year planning process for allocating funds, and of those five years, the competition for resources in the first two years is by far the keenest, as those are the budget numbers that Congress will review and ultimately decide whether or not to fund, and at what level. Threats and risks beyond five years are considered, but in a more indirect manner. Oftentimes, the Pentagon will try to use some type of hedging strategy or acquire capable systems with multimission potential, so regardless of how the exact future evolves, there will be suitable capability and capacity in the inventory to address whatever threats and missions are most prevalent. Ten years ago, much of climate change risk was perceived as both incremental and in the "out-years" (beyond the immediate budget). This happens with many threats, both real and imagined. For example, terrorism and violent extremism did not move to the funding forefront until 9/11, despite the many warnings in the 1980s and 1990s that these threats were growing. It's not that the Pentagon is unaware of these threats and risks, but which ones will become imminent and require a response? Today, the Pentagon is grappling with cyber threats, great power competition in undersea, air, and space domains, hypersonic weapons, and artificial intelligence, and is now doing so in a physical environment that is no longer stable. The eternal question: how do you allocate your time, money, and focus to best address these collective challenges?

Both the White House and Congress matter – and they matter a lot. It's almost too easy to feel confident, possibly even a bit smug, coming to Capitol Hill as a senior naval officer working in the Department of Defense. You will quickly find, though, that many members of Congress and their senior staff carry with them a pocket version of our Constitution, and are ready to break out Article One at a moment's notice, and remind you, subtly or otherwise, who has the power of legislation and the power of the purse.

The president is, of course, the commander in chief, and all budget requests are ultimately approved by the White House. However, for any program to be funded and enacted into law, it must first be approved by both chambers of the U.S. Congress. Good, bad, or indifferent, that is our system of government and the reality and prism through which the Pentagon (and all executive branch departments) view the world. If either the White House or Congress is hostile to a program or policy, its likelihood of seeing the light of day is greatly reduced. One of the big frustrations, or tragedies, of the past decade has been the inability of Congress and the Executive Branch to come to consensus on how best to address the risks of climate change to our security. During the second term of the Obama admin-

istration, there was a lot of momentum at the political level to raise awareness of this issue. Unfortunately, that rhetoric did not translate into discrete budget or program requests. At the same time, the Republican majorities in the Senate and, after 2014, in the House were implacably opposed to the idea that climate change was impacting security (or anything else). Without an effective legislative strategy to counter that opposition, much less was done than said about climate risks in the military and, as the years went on, there was increasing skepticism that this was a real issue, rather than a political talking point used by the White House. Ironically, the positions of Congress and the Executive Branch have changed with the election of President Trump. We now have an administration in which it is hazardous to your career's health to bring up climate risks in any form, while Congress has moved from antagonist-in-chief to becoming a cautious advocate for the military's adaptation to climate risks.

This is especially true for Arctic issues, but it is also true for protection of domestic military infrastructure against climate impacts. The Arctic, in particular, is a combination of strange bedfellows and stranger politics, where there are converging bipartisan interests in trade (Maine), ship construction (Gulf Coast), ship homeporting (Washington State), and fossil fuel, infrastructure development, and employment (Alaska).

It's fair to ask, with a decade of hindsight, what was accomplished. With the caveat that I am far from an unbiased observer, here are five areas in which I believe the Navy's focus on climate risk made a positive difference.

Changed external perception. Arguably the biggest change the TFCC made was in how the U.S. military, and the Navy in particular, was viewed in addressing an issue of future critical importance to many people around the world. Simply by directly addressing climate change as a risk and talking about it in plain, "non-Defense speak" language, many in Congress, the media, nongovernmental organizations (NGO), and the general public understood that this was an issue the Navy was serious about.

That perception extended beyond our borders. I had the opportunity and privilege to represent the DOD at the UN Conference of the Parties (COP) 15, 16, and 17, held in Copenhagen, Cancun, and Durban, respectively. One of my favorite things I did while at the COP was to walk through the nongovernmental organization halls and exhibits, while in my naval uniform. The reaction of the people, most of whom were not U.S. citizens, staffing the NGO booths, was uniformly one of surprise, interest, and respect. Simply having the U.S. military show up at these COPs and talk seriously about climate risks was a significant contribution to "soft power" and helped raise the reputation of the U.S. military with people who otherwise have almost no contact with our servicemen and women and often had negative stereotypes about the DOD.

Thanks to an aggressive media and public-speaking campaign, the Navy was also able to educate the public on its thoughts and actions regarding climate change. Both the Arctic and Climate Change Roadmaps, published in late 2009 and early 2010, respectively, were unclassified and distributed widely.⁴ In addition to using traditional methods of outreach, the TFCC engaged extensively on social media; I also participated in the first (and only) TEDxPentagon.⁵ Despite the relatively low number of views (a little over 33,000), this video seemed to have a wide impact, as many people I subsequently met referenced it frequently.

Changed internal culture. Just as important as influencing people beyond the military was the task of changing culture within the Navy and the Building. In settings both formal and informal, socializing the risks from a changing climate in terms and interests that would resonate with other officers and civilians was a daily task on the to-do list. By far, the most common reaction I received was not one of skepticism or disbelief, but rather a reaction along the lines of “I had never really thought of that before.” Interest, of course, does not equate to resources to fund a program. However, we were able to make much progress against an initial perception that this was a fringe issue, an issue out in the distant future, or of interest only to hard-core environmental NGOs. The education process was constant, and one of the lessons learned is you could not – and should not – assume a uniform starting point in knowledge or preconceived notions on this subject.

One of the truisms about the U.S. Navy, and most military services, is that for better or worse, it is a very top-down, hierarchical organization. Having the explicit backing of the CNO was invaluable. As the most senior officer in the Navy, he provided interest and top-cover to ensure his leadership would at least listen to my arguments. As the saying goes, “if the boss is interested, you are fascinated.” Leveraging this fact of life helped greatly in accelerating progress and surmounting the normal, but still formidable bureaucratic challenges in introducing any new idea into a large organization.

Started the analysis and discussion. By engaging the operational, headquarters, and acquisition components of the Navy, the Task Force was able to produce Navy-wide roadmaps with specific goals, actions, and milestones to prepare for both a changing Arctic and changing climate. These roadmaps not only led to further action, but also initiated discussions and analysis with both internal Navy analysis groups and external programs such as the General Accountability Office, Congressional Research Service, and National Academy of Sciences. The Task Force acted as both a “forcing function” and as an integration office to coordinate multiple analyses initiated by a number of organizations both within and beyond the Navy.

Funded some needed programs. While there have been no major (as in billions of dollars) programs funded directly because of the work of the TFCC, the Navy did reinvest in Arctic research through the Office of Naval Research. The Navy also

started a new program, the Earth System Prediction Program (ESPC), to seamlessly provide weather, ocean, and ice predictions from the near-term out through thirty years. The ESPC, now nearly a decade old, has been recognized in the Weather Research and Forecasting Innovation Act of 2017 as a pathfinding program for the entire U.S. government, and the National Oceanic and Atmospheric Administration has been directed to coordinate its modeling efforts with the ESPC.

Showed the way. I believe the TFCC showed the DOD and the other military services that you could have a discussion and talk openly about the issues of a changing climate and its impacts on readiness, without becoming unduly mired in the partisan and tribal debates that unfortunately surround this issue. The TFCC Arctic and Climate Roadmaps preceded the DOD's 2010 QDR and the ensuing climate and Arctic strategies issued by the DOD itself. I'm very pleased to see that both the Army and Air Force are now spending intellectual and analytic effort to determine the risks and mitigation strategies to their respective missions and forces.

In addition to leading within the U.S. military, I'm proud of the work we did, in collaboration with the Office of the Secretary of Defense, the U.S. European Command, and our Norwegian allies, to create and hold the first meetings of the Arctic Security Forces Roundtable (ASFR). Since the Arctic Council is, by charter, prohibited from discussing military security issues, we created a forum whereby all the militaries of the Arctic countries could come together in a neutral environment and discuss issues of mutual importance. One of the highlights of my naval career was cochairing the inaugural meeting of the ASFR in 2011 in Oslo. I'm pleased that even a decade after the ASFR's creation, it is still relevant and referenced in today's policy discussions.⁶

In my years since retiring from the Navy, I have continued to work at the intersection of climate change, risk, and national security. While progress is never a straight line, I have been heartened by the number of NGOs that, over the past decade, have devoted increasing resources to studying, writing, and speaking out on this topic. I am particularly pleased to observe the evolution in Congress on this issue, especially on the Republican side of the aisle.

A little-noticed, but watershed moment came in the summer of 2017 in the then-Republican controlled House of Representatives. The full House took a vote on whether to include a modest climate amendment (the Langevin amendment) into the upcoming annual Defense authorization bill. To everyone's surprise, including Congressman Jim Langevin, the amendment passed the full House, with more than a handful of Republican votes. The subsequent analysis of which Republicans voted for the measure contained another surprise: it wasn't about whether there was a military installation in their district, or even if they were directly impacted by rising sea levels. The dominant factor was how "purple" their district was turning on the issue of climate change, reaffirming former Speaker

Tip O'Neill's old cliché about all politics being local. As much as those of us who work on climate issues would like to think our facts, with our tightly constructed arguments and crisp graphics, substantially influenced the debate, it was the members' perception of the political calculations in their district that carried the greatest weight.

I have often said that while Congress will not lead on the issue of managing climate change, it can be led. And it will be led by the voters. Contrary to stereotype, almost all members of Congress are acutely in tune with their constituents. If not, they quickly find themselves unemployed. They know what their voters do – and do not – care about. When they determine that a significant number of their constituents demand climate action, we will see meaningful legislation and we will see it quickly. But first, enough people need to care enough.

That is why, in addition to spending time with congressional members and their staffs and having testified nearly a dozen times on climate-related matters since retiring from the Navy, I have given hundreds of climate-related talks around the country. If my message of pragmatic security risks to our country from climate change, combined with my background of thirty-two years as a naval officer, can reach and convince some members of the public who might otherwise tune out environmentalists, then it's worth the time sitting on an airplane and subjecting myself to the niceties of the Transportation Security Agency.

To the question posed in the title of this essay: was the Navy's Task Force Climate Change an exercise in futility, or was it setting the pace for future challenges that we know will come? I think the answer is a bit like a Rorschach test: yes, depending on how you look at it.

I'm writing as our nation is under *de facto* lockdown from uncontrolled transmission of the COVID-19 virus. Right now, no one knows how many people will die, what short- and long-term damage will be done to people's livelihoods, or how long this will last. The virus moves at a pace nearly three orders of magnitude more quickly than climate change (days and weeks versus years and decades). Just like climate change, the U.S. intelligence community had warned of the possibility of a pandemic. Just like climate change, those warnings were mostly unheeded. Serious actions did not happen until significant numbers of people started dying close to home. As I write, we don't know if those actions will be sufficient to control the worst of the health catastrophe. In that aspect, the TFCC likely joins the long list of Patron Saints of Lost Causes.

There is another side to this coin, though. General Eisenhower's much used saying about plans and planning may be relevant here. The fact that the TFCC forced the Navy, and the Defense Department, to think seriously, at least for a time, about the impacts of climate change to our security was, in my opinion, time well spent. Some of that culture will remain in the military, through the teachings

at the services' war colleges and recently renewed interest in Arctic operations. Perhaps the TFCC was a decade or so ahead of its time, but I do believe history's ultimate verdict will be that it was time and effort not wasted.

While I do not subscribe to the "we are all doomed in twelve years" theory of catastrophic climate change, the evidence is overwhelming that the more we can do to reduce net greenhouse gas emissions and the more quickly we can do it, the more we will buy down the risks of extreme weather and unmanageable sea level rise and ocean acidification. We will buy down those risks not only for future generations, but for us, and not only for people living continents away, but for our families, friends, and neighbors in our own communities.

After all, the ice does not care who is in power, or who is tweeting what – it just melts.

AUTHOR'S NOTE

I would like to express my gratitude to Dr. Katarzyna Zysk, Professor of International Relations and Deputy Director at the Norwegian Institute of Defense Studies. Her candid, thoughtful, and constructive comments significantly improved the quality of this essay. Any remaining errors are, of course, my responsibility.

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Seeing Is Believing: Understanding & Aiding Human Responses to Global Climate Change

Elke U. Weber

This essay traces my academic voyage from studying human perceptions of financial risk to the realization that the human response to climate change is a more fundamental and profound challenge. Along the way, I came to realize that different academic disciplines need to be recruited for two purposes: 1) to tell an accurate story about the motivations and processes by which environmental (and other) decisions get made by stakeholders that range from policy-makers in the public and private sector to the general public; and 2) to determine and implement effective and feasible ways of changing the physical, institutional, and social environment to help myopic decision-makers achieve long(er)-term objectives. I see my voyage as an exercise in applied hope, resisting the constraints that disciplines and academia try to place on scholars and helping others to do so as well, by both example and institution-building.

Be neither an optimist nor a pessimist. Both are different forms of fatalism. Instead, practice what I call *applied hope*: believe our world and the causes you care about can get better, and work to make them so.

—Amory Lovins¹

This is the intellectual puzzle of our time: what lies at the root of pervasive inaction, wishful thinking, and denial in the face of global climate change, a hazard with potentially catastrophic consequences for the continued habitation of the human species on planet Earth? In this essay, I trace my academic voyage from studying human perceptions of financial risk to the realization that the human response to climate change is a more fundamental and profound challenge. Climate change shares all the characteristics that make wise responding hard in other individual and societal problem settings, from insufficient retirement savings to the opioid epidemic and obesity, but more so. On this personal trajectory, I came to realize that different academic disciplines need to be recruited for two purposes: 1) to tell an accurate story about the motivations and process-

es by which environmental (and other) decisions get made by stakeholders that range from policy-makers in the public and private sector to the general public; and 2) to determine and implement effective and feasible ways of changing the physical, institutional, and social environment to help myopic decision-makers achieve long(er)-term objectives. Stops along this voyage will revisit the establishment of an interdisciplinary center that created a new area of research and will describe the rewards and challenges of leaving the comfort zone of one's academic discipline and of actively translating and exporting academic insights for use in the proverbial "real world."

Academic writing typically does not happen in the first person singular, but the invitation to bear witness on climate change as an academic and societal challenge suggests a personal as well as a professional account. I take this opportunity to reflect back on the journey that has brought me to this juncture of addressing the intellectual puzzle of our time described above: Why is it that the well-documented threats of global and potentially catastrophic climate change do not move national governments, corporations, or large segments of civil society to more fully consider mitigative or even protective action? Why is it or how is it that so many of us prefer to engage in the wishful thinking and denial of inconvenient facts that may well imperil the comfortable existence of future generations of the human species on planet Earth?

I started on my academic path with Ph.D. research at Harvard's program on behavior and decision analysis within the department of psychology and, by my own initiative, at Harvard Business School, modeling and empirically investigating people's perceptions of risk, mostly in the context of risky financial investment decisions. Serendipity, in my first faculty position in quantitative psychology at the University of Illinois at Urbana-Champaign, led me to a group of agricultural economists who were interested in studying awareness about and actions in the face of potential climate change among farmers in East Central Illinois. I joined the team as someone with expertise in interviews and surveys and, through the research, discovered the first instantiation of what I later came to call *the single-action bias*: namely, the tendency of people (in this case, farmers) who are responding to a threat to rely on a single action when other actions exist, even when the single action provides only incremental risk reduction and may not even be the most effective option.² My senior colleague at Carnegie Mellon University, Baruch Fischhoff, one of the few psychologists at the time interested in applying psychological theory to solve real-world problems (and a long-standing role model and mentor), learned about my foray into climate change research and would pass my name on to National Research Council committees and other organizations looking for a psychologist with expertise and interest in the topic, whenever he could not or did not want to take on an invitation. By contributing to reports

like those written by social and environmental scientist Paul Stern and geoscientist Bill Easterling, I learned to appreciate the value that interdisciplinary collaborations between the physical and social sciences as well as across different social and behavioral sciences bring to the challenges of climate change action.³

This essay is a welcome opportunity to take stock of the fundamental insights about climate change perceptions and action that I arrived at over these past thirty-five years. Here are my top three: 1) climate change does not elicit sufficient fear or dread; 2) motivating climate action through fear or guilt is a bad idea even though it might sound like an effective approach; and 3) we need to help people recognize their personal experience of the concrete impacts of climate change on their lives, though this is easier said than done and may not work for everyone.

My first insight, that climate change does not elicit sufficient fear or dread to motivate action, not surprisingly builds on the foundational work by Baruch Fischhoff and his colleagues Paul Slovic and Sarah Lichtenstein on psychological risk dimensions. I put this insight forth as a hypothesis fifteen years ago at a meeting at Princeton organized by geoscientist Michael Oppenheimer, expecting others to put it to the test.⁴ Eventually, one of my Ph.D. students took the bait and set out to replicate and expand the classic Lichtenstein and colleagues study on psychological risk dimensions, which now also included climate change, global warming, and a list of extreme weather events and natural disasters known to be exacerbated in frequency or intensity by climate change.⁵ As predicted, people's perceptions of the composite "dread" variable for climate change (or global warming, the label for the hazard did not matter) were far below the average for all hazards, while the perhaps more concrete extreme weather events or natural disasters scored high.

This suggests that it would not be easy to motivate climate action by fear, since climate change does not elicit visceral responses of dread. But even if climate change were dreaded, would it be a good idea to use this fear or the guilt of not contributing to a solution as a motivator for action? My second theoretical and empirical insight suggests that the answer to this question is no, given that effective climate change action requires sustained attention and action over time. Negative messaging that elicits fear or guilt gets attention, but people want to get out of the negative mood state quickly because it is unpleasant, leading among other things to the single-action bias mentioned earlier, where the fear-motivated flag for action goes down after the first protective or corrective action is taken. Positive messaging and information about a way forward, on the other hand, are far more effective motivators for the long haul. One particularly effective positive emotion is pride. Campaigns that make people anticipate the pride of being part of the solution (rather than the guilt of being part of the problem) have proven to be a far better strategy, both in controlled tests in the lab and in field settings that range from the conservation of birds in the Caribbean and fisheries in the Philip-

piners by the NGO Rare.org to the preservation of coral reefs with the help of cane farmers in Queensland, Australia, by the company Evidn.⁶ I have been impressed by both of these organizations with whom I have had the opportunity to interact for the way in which they have been putting behavioral science principles to good use.

My third insight relates to the fact that personal experience is a powerful teacher, far more convincing than pallid statistics, even if the latter carry greater evidentiary value.⁷ This insight is alluded to in the title of this essay: “Seeing Is Believing.” But as is often true in psychology (not a logically consistent and internally coherent social science discipline like economics), the opposite can also be the case: namely, that “believing is seeing.” In other words, people are often committed to their beliefs, especially when those beliefs are visibly and vocally shared by others in their tribe, and will selectively attend to information that confirms those beliefs and fail to see evidence that contradicts them. This, of course, explains the increasing polarization of climate change beliefs.⁸

Building bridges and commuting on those bridges between continents and academic disciplines has been a strong metaphor in my life, from living and working in some form or other in both North America (Canada and the United States) and Europe, to trying to draw on, reconcile, and integrate theoretical frameworks and empirical tools from psychology, economics, and other behavioral disciplines. “Combine and conquer,” a phrase I coined in 1984, has been an epistemic theme in my work, a call to arms and part of the title of more than one paper.⁹ It reflects my belief that multiple academic disciplines are needed to understand the motivations and processes by which environmental decisions get made by actors that include the general public as well as professional decision-makers. Contrary to the prevalent implicit assumption in policy circles, not all decisions are made solely by rational deliberation, but also involve emotional reactions and, frequently, the implicit or explicit application of rules (such as standard-operating procedures, best practices, and moral or ethical rules of conduct) that follow from people’s social or professional identity.¹⁰ People have many and often conflicting goals, and preferences are not the primitive they are assumed to be in economics, but often get constructed in real time and thus are influenced by the subset of goals that are activated by the physical and social environment in which the decision is being made.¹¹ Cultural environments vary in the chronic activation levels that different goals have through pervasive prompts that range from nursery rhymes to proverbs, advertisements, and spoken and unspoken social norms that communicate long-standing shared values.¹² But across all cultures, boundedly rational humans with limited attention and processing capacity are paying more attention to goals that are close in physical and psychological space and time, suggesting that attention to longer-term objectives needs to be

actively primed and solicited.¹³ The fact that our preferences are often constructed also suggests that they can and may change. This is an important fact to know for politicians and other elected officials, who may govern by opinion polls rather than proposing climate (and other policies) that increase public welfare and achieve long(er)-term sustainability and social equity objectives, for fear of their chances for re-election. There is evidence that initially unpopular policies (like the 2009 carbon tax by the Canadian provincial government of British Columbia and the 2002 smoking ban in public places by New York City) can become popular within one or two years of their implementation, suggesting that public opinion can be educated by evidence of the benefits of change and that status quo bias can be a transient phenomenon.¹⁴ The current COVID-19 crisis shows that paternalism need not be a dirty word. Crisis situations call for leadership and tough love on the part of public policy-makers, where actions that are in the long-term public interest may need to and should be mandated for the benefit of all.

Last we looked at the physical trajectory of my career, I was at the University of Illinois at Urbana-Champaign. My three years there were followed by seven years at the University of Chicago and then four very productive and enjoyable years at the Ohio State University. A new marriage then brought me to Columbia University and its Earth Institute in 1999, where I founded the Center for Decision Sciences with my colleague Eric Johnson and then, in 2002, as an offshoot, the Center for Research on Environmental Decisions (CRED) with my colleague David Krantz. CRED came into existence as the result of a National Science Foundation solicitation for interdisciplinary social science collaborations that would address climate change perceptions, beliefs, and actions, funded by the George W. Bush administration as an excuse to delay ratification of the Kyoto agreement (“more research” was first needed on climate change). CRED reversed the usual way in which the physical and climate sciences and the behavioral sciences cooperated: instead of the climate sciences playing the central role and the behavioral sciences being recruited toward the end in (only) a supporting capacity to help craft climate change communications, CRED put psychology, anthropology, and behavioral economics center stage for their theories and methods, assisted by input from the climate sciences as needed. In the process of doing so, CRED helped to create a new interdisciplinary subdiscipline called environmental decision-making, now being pursued in other places around the country and the world. CRED’s lessons and takeaways were translated into an accessible and actionable format from the numerous academic publications that its researchers generated to two Climate Change Communication Guides, one published in 2009 and an update and expansion published in conjunction with *ecoAmerica* in 2014.¹⁵ These publications are being used by a wide range of organizations around the country, such as the Central Park Zoo, which uses them to train its volunteer

docents in climate change communication. CRED has trained many Ph.D. students and postdocs who have since gone on to academic and applied positions around the world, a valuable contribution in light of Patrick Kinney's comment in this issue of *Dædalus* about the importance of early training in multidisciplinary collaboration.

In 2016, I moved to Princeton, where I founded the Behavioral Science for Policy Lab (BSPL), located in the Andlinger Center for Energy and the Environment and bridging to the School for Public and International Affairs, the Department of Ecology and Evolutionary Biology, and the Department of Psychology, with Ph.D. students and postdocs from across the university. The decision to leave Columbia University and my two centers there was motivated by a desire to expand even further the range of disciplines, theories, and tools to be brought to bear on environmental decision-making and climate change (in)action. I felt that the field had gotten a good grasp of the cognitive and motivational barriers to climate action at the individual actor level and so, in collaboration with the Behavioral Science and Policy Association, I organized an expert summit that prepared an integrative summary of the behavioral science tools that can improve and strengthen energy and environmental policy.¹⁶ At the same time, I felt that this knowledge and resulting efforts to design interventions to overcome or circumvent barriers to change ("choice architecture") was not at all integrated into theories, models, and analyses of action at the social, organizational, and collective level. Some months spent in 2012 on sabbatical leave to Princeton, with the interdisciplinary research community *Communicating Uncertainty: Science, Institutions, and Ethics in the Politics of Global Climate Change* at the Princeton Institute for International and Regional Studies, had taught me that I would find invaluable colleagues on that front at Princeton.

For the past four years, my Ph.D. students and postdocs at the BSPL, in collaboration with colleagues across Princeton and around the world (at the Stockholm Resilience Center, the Potsdam Institute for Climate Impact Research, and the University of St. Gallen, among others), have been investigating environmental and conservation decisions by individuals in their physical and social environments, and the decisions made by households, firms, city councils, and other organizations. We are actively working on bringing in disciplines that better speak to the role of the physical and social contexts in such decisions, including sociology and social network theory, philosophy and social norm theory, and evolution and ecology and complex adaptive systems theory.

While it has been gratifying to build local centers of research on the questions of great theoretical and societal importance and to train and cross-train scores of undergraduate and graduate students and postdocs in the requisite theories and methods, it has always been obvious to me that the demand for such research, training, and insights far outstrips the supply. Many (if not most) psychologists, (behavioral) economists, organization scholars, anthropologists, sociologists,

and political scientists are more comfortable pursuing discipline-based research questions that address relatively narrow theoretical or empirical issues than engaging in the time-consuming and often initially challenging efforts to learn and integrate the vocabulary, frameworks, and methods of neighboring disciplines. The sad truth is that interdisciplinary research or even disciplinary research designed to address important social issues is currently not highly valued within the academy, an observation seconded by several other contributors to this volume, including Rebecca Henderson and Patrick Kinney. What any individual can do to change this situation so as not to disadvantage young interdisciplinary academics when they are being considered for promotion and tenure, for example, is minimal, but I have been trying to do so anyway (among other ways by serving on bodies like Columbia's Tenure Review Advisory Committee that advises the provost on such decisions). This illustrates another long-standing belief of mine: that life is a battle between aspiration and hope over realism and despair; and that action wins the day, as expressed by Amory Lovins at the beginning of this essay. Albert Camus's "Myth of Sisyphus" tells a similar story, and the sentiment that one "must imagine Sisyphus happy" has long resonated with me as very true. Pursuing the goals outlined above for their intrinsic value and rewards, against temporary setbacks but with frequent longer-term victories, has been a rewarding and largely happy endeavor.

So what boulders have I tried to roll uphill in an effort to make interdisciplinary research on responses to climate change more appealing and more rewarding for my students, young colleagues, and future generations? First, I have been trying to lead by example and to show by my own work that fundamental psychological theory can be adjudicated and advanced extremely well or perhaps even better when examined in the context of real-world problems than in stylized lab settings with abstract content. For me that has resulted in advancing theory on a variety of issues including risk-taking (risk as feelings, domain-specific risk-taking, single-action bias), decision modes, and decisions from memory and experience. Second, I have been willing to contribute to organizational attempts to publicize the need for and utility of such efforts: two notable examples have been the creation of a report by the American Psychological Association about the role of psychology in addressing the global climate challenge and, more recently, the creation of an expert panel and resulting report on the role of behavioral science in the process of designing (physically and metaphorically) for sustainability, organized by the journal *Nature Sustainability*.¹⁷ Third, I have helped create attractive high-profile publication outlets for interdisciplinary research on climate action in the form of special issues of top journals, in one case, a special issue on political cognition in *Cognition* and, in another case, a special issue on the business of climate change in *Management Science*.¹⁸ The importance of better understand-

ing the ability, willingness, as well as resistance of the business sector to integrate climate change into its operations, goals, and strategic planning is well described by Rebecca Henderson in her essay in this volume. Addressing corporate climate change efforts and barriers as well as opportunities for change is high on my lab's current agenda.

In my research efforts and center activities described above, I have been keenly aware of the need not only to generate research insights, but also to get them out of the ivory tower and into the hands of potential users. I have been trying to do just that in two ways. One has been an active effort to translate research insights from the academes of professional journals into the English, Spanish, or Chinese spoken by potential audiences of users and published in the form of blog posts or op-ed pieces. Thus, academic insights about cognitive myopia and status-quo bias became op-ed pieces for *The Daily Climate* and a paper for Argentinian farmers in their *Ag-Extension* magazine;¹⁹ academic insights about how to promote longer time horizons in decision-making became an article in *The Huffington Post* and a post on the *Climate Strategies & Climate Policy Blog*;²⁰ and academic insights about the role of habits in energy use and carbon dioxide emissions became an article in the Chinese *Boao Review*.²¹ As a complement to such translation in writing, I have also been presenting the policy and action implications of this research (my own and those of students and colleagues) to professional organizations, NGOs, and governmental and intergovernmental agencies, sometimes at workshops or invited talks (such as at the UN and the White House), other times by serving on scientific advisory boards (such as chairing the Green Growth Knowledge Platform of the Organisation for Economic Co-operation and Development, the UN Environment Programme, and the World Bank, or serving on the science advisory boards of the U.S. Environmental Protection Agency and the environmental NGO Rare). I sometimes refer to these activities as missionary work to promote recognition of the crucial role that the behavioral sciences (including but notably beyond economics) can play in the design and effective implementation of policy. With this mission in mind, I have been serving since 2012 as lead author on the Fifth and now the Sixth Assessment Report by the UN Intergovernmental Panel on Climate Change (IPCC), inserting the first mention of nonrational choice processes into a chapter on risk management in 2014 and now working on a chapter on demand-side solutions.²²

It is important to demonstrate that complex human responses to climate change information (that is, responses that go beyond rational accounting but include emotion and social elements and biases) are not just encountered among members of the general public (consumers or voters), but also among professional decision-makers. In this spirit, I have been conducting studies and experiments in which infrastructure engineers or climate negotiators at the UN Conference of the Parties are the target populations.²³

Given that our responses to climate change are based on personal experience and emotional and social responses as much or more than on rational deliberation, I have also attempted to connect and work with boundary organizations that communicate climate risk information and climate solutions in more experiential ways and in less polarized cultural settings. This has included serving on the science advisory boards of the Climate Museum in New York City and of UN Live, the UN Museum for Humanity, and contributing to efforts by artists like the sculptor Olafur Eliasson or to plays like *The Great Immensity* by The Civilians.²⁴

Leading by example has been another maxim of my life. Doing so in the context of climate action is not always easy. In a project led by a former CRED postdoc, we show that it matters to members of the American public across the political spectrum that climate scientists who deliver suggestions for personal action on climate change in the form of lifestyle changes or policy support “walk the talk.”²⁵ In a world of multiple goals (with professional obligations to present work at international conferences, IPCC meetings in far-away locations, and family obligations in the form of aging parents in Germany), walking the talk in the form of changing one’s diet and restricting one’s air travel is not always easy, but is an objective that should be given constant attention, an issue also addressed eloquently in Jessica Green’s essay in this volume.²⁶

Climate change denial is something all of us engage in to different degrees. Denial, like all defense mechanisms, enables us to function and attend to other goals and objectives when the challenges of climate change seem overwhelming and the solution space not very feasible. I see similarities to how we deal with knowledge of our mortality: both are massive problems without obvious easy solutions, where it makes sense to turn away from the problem at times, as otherwise despair and nihilism may set in. Understanding why and how we turn to different forms of denial or wishful thinking in both cases can help us think about alternatives. My personal alternative has already been alluded to in the opening quote: practicing “applied hope” in the shape of working to make things better, in my case by researching and applying (behavioral) science to help design and implement better climate change policies and responses. Looking back on my professional life has made it apparent that I really am an engineer at heart, someone who appreciates and uses science, including social science, to make things better. In this sense, it seems very fitting that I have made the Andlinger Center for Energy and the Environment my current home, as it resides in Princeton’s School of Engineering and Applied Science.

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Less Talk, More Walk: Why Climate Change Demands Activism in the Academy

Jessica F. Green

As climate scholars, it is our professional responsibility to engage in climate politics. First, we need to engage in radical scientific analysis: we must ask questions that get at the root of climate change. Second, we need to plant a flag: we must be explicit about what our findings indicate we should do. This should go further than laying out the options; we must indicate which among them is preferable and why. Third, we must engage broadly, both across disciplines and beyond the academy. Many will object to the notion of engaging publicly as advocates, but the climate crisis demands nothing less. Choosing not to have a view, in the name of preserving our expertise, is an abdication of our responsibility, as both scholars and teachers.

As a graduate student in political science, I learned to be objective. I was taught to be analytical, methodical, and scientific. I learned to proceed incrementally: immersing myself in others' research, meticulously assembling modest, falsifiable hypotheses, then dutifully reporting the sources of bias, potential problems, and, with trepidation, my findings. In short, I had politics trained out of me. Instead of engaging in climate politics – my area of expertise – I studied them. Instead of advocating, I analyzed. After all, expertise, not activism, is the path toward tenure. Yet I felt that I was shirking my political responsibility as a scholar to *do* something.

I struggled mightily with this problem, trying to walk a line between producing peer-reviewed articles and public-facing work, hoping that the latter would not undercut my credibility as an international relations (IR) scholar. Of course, I did other things on the side: protesting, organizing for pro-climate candidates, and the like. But I felt that as a scholar of climate politics, I was, along with my colleagues, in a unique position to participate in political debates.

Yet the discipline of political science neither expects nor rewards such engagement. We are rewarded, first and foremost, for engaging with each other, through peer-reviewed publications and conferences. Only the most senior among us re-

ceive accolades for public engagement. There is a small cohort (who skew younger) who are committed to engaged scholarship, but they are in the minority within the discipline.

Then I got tenure. With it, I can worry less about getting published, and am able to focus more of my energy instead on trying, in my own corner of the universe, to shape the discourse about the future of climate policy.

But most scholars – especially the growing number of us who are part of the “precariat” on temporary teaching contracts – do not have this luxury. As a result, we tend to ask narrow “impartial” questions that can be answered in an empirically rigorous way, and we shy away from bolder questions that we *should* be asking. The dominance of positivist inquiry in political science, which emphasizes hypothesis-testing and generalizable results, has solidified this practice.¹ One critic, political scientist Jonathan Isacoff, suggests that this has driven many international relations scholars away from “human woe and issues that matter” to “the self-definitionally obsessed, paradigm-driven culture of academic IR.”²

I publicly and emphatically reject this expectation. I echo Dennis Thompson’s argument in this volume of *Dædalus* that “the professional’s obligation to witness is different from *and stronger than* the obligation that they may have as a citizen.”³ As climate scholars, it is our professional responsibility to engage in climate politics and use our expertise to serve as advocates, to identify the political causes of climate inaction as well as solutions to overcome them.

Many will object to the notion of engaging publicly *as advocates*. By advocating, we undermine our credibility, and without credibility, no one will listen to us. But consider the counterarguments. As human beings, we are in a fight for our collective survival. This takes precedence over our precious credibility. And this is why respected conservation scientists have called for civil disobedience.⁴ By doggedly insisting that speaking truth to power will effect the necessary societal changes, we undercut our credibility as moral actors.

We are living in an age of rising populism and a corresponding distrust of experts. Our vaunted positions as experts are perhaps not as respected as we might think. Finally, and most important, if we don’t talk – loudly and forcefully, to be heard above the din and false information – no one will listen. If we don’t clearly voice our views in public-facing venues to counteract misinformation, which is often amplified through echo chambers, our knowledge will be irrelevant.⁵

What does it mean to walk the walk? I am not proposing that academics involved in climate politics should become lobbyists. Rather, there are three ways that we can advocate *in our expert capacity*. First, we need to engage in radical scientific analysis: we must ask questions that get at the *root* of climate change. Second, we need to plant a flag: we must be explicit about what our findings indicate we should *do*. This should go further than laying out the op-

tions; we must indicate which among them is preferable and why. Third, we must engage broadly, both across disciplines and beyond the academy. We can do more than publish op-eds (though we should do that too). We should consider ourselves idea machines for those engaged in both political debate and policy design. We must remember that policy is not a substitute for politics. Without political power, policy is unlikely to advance.

Ask radical questions. We need to ask those radical questions that get at the root of the problem. Climate change is not about science, but about politics. It requires elaborating a new theory of political economy that puts the climate crisis front and center. Radical questions will clarify power asymmetries and identify obstacles to change. Asking big questions about climate politics may seem an obvious first step, but it is not as pervasive as one might expect. In fact, as evidenced by an analysis of articles published in the field's top journals, in international relations, we have hardly discussed climate change at all.⁶

International relations scholars have tended to treat climate change more as an economic problem than a political one. This is evidenced by the dominant view that climate change is largely a collective action problem that requires cooperation among all nations to mitigate greenhouse gas emissions.⁷ In this game-theoretic view, climate "politics" is reduced to conditional cooperation: nations will reduce emissions as long as they are guaranteed that others will do the same.⁸ Ultimately, IR scholars' propensity to cast climate change as a collective action problem fails to elaborate *who* constitutes the collective beyond the black box of the nation-state.⁹

From the collective action view, the main challenge is to deter free-riding: that is, to prevent nations from shirking obligations to reduce. The political solution is to create binding legal commitments to cut emissions, coupled with a mechanism to punish nations that fail to meet their goals. This was precisely the logic of the Kyoto Protocol. Yet Kyoto was politically untenable.¹⁰

Why? Because the real challenges to effective climate action are political, and often occur at the domestic rather than the international level.¹¹ We know from more recent political science research that obstructionism by fossil fuel companies, electric utilities, and other owners of climate-forcing assets – those that contribute to climate change – are significant obstacles to decarbonization.¹² Yet scholars have only begun to study the impact of climate obstructionists at the international level, even as the timeline for far-reaching action tightens.¹³

Instead, research has focused on how nation-states can cooperate with firms and multinationals to find innovative solutions to climate change.¹⁴ While some of this work is skeptical about the effects of such cooperative efforts,¹⁵ it is inherently focused on cooperation, rather than obstructionism. This is wrongheaded. Indeed, research in progress on investor-owned fossil companies shows that even "leaders" like Shell and BP have moved little on diversifying away from fossil fuel holdings.¹⁶ By focusing on collective action rather than obstructionism, we have

largely ignored the “existential politics” of climate change: the political conflicts embedded in the current international system.¹⁷

It is important to emphasize that investigating such radical questions can and should be done in a rigorous manner. For example, the aforementioned research on investor-owned fossil fuel companies has demonstrated empirically, using original data, that participation in voluntary climate partnerships – where NGOs or firms decide to collaborate on a jointly agreed climate goal – is not correlated with reductions in firm emissions.¹⁸ While not a causal explanation, this provides a preliminary indication that voluntary partnerships – which have been touted as an important way to engage the private sector in climate mitigation – do not appear to be reducing emissions of key actors.

Asking radical questions also means that we must be wary of incrementalism, for two reasons. First, it is an understatement to say that the science is clear. We know that drastic action on decarbonization is needed if we are to avoid catastrophic effects of climate change, which will fall disproportionately on those least responsible.¹⁹ Incremental responses are morally dubious, as they will still condemn many to death and suffering.²⁰

Second, studying incremental approaches has the unintended effect of validating them, skewing our focus toward short-term, small wins when we should be considering long-term, large-scale change.²¹ Thus, much ink has been spilt debating the appropriate design of a carbon price, despite the fact that in the majority of cases, it has had limited effects on emissions.²² There are surprisingly few post hoc analyses of the extent to which pricing reduces emissions.²³

Thus, the oft-repeated received wisdom that carbon pricing must be part of a global response to climate change is not definitively supported by extensive evidence. For example, the European Union has the oldest and largest emissions trading system. Yet the few analyses of its effects on emissions are mixed. According to some studies, the European Union Emissions Trading System (EU ETS) resulted in limited reductions: between 2 percent and 8 percent in Phases I (2005 – 2007) and II (2008 – 2012) of the EU ETS.²⁴ But different studies have found otherwise. For instance, economists Germà Bel and Stephan Joseph found that the majority of emissions reductions in the EU between 2005 and 2012 can be attributed to the global financial crisis.²⁵ Moreover, we know that causal inference is difficult due to the variety of other policies simultaneously employed to reduce emissions.

Discussions of how to reform or improve current policies imply that carbon pricing is desirable. Yet the empirical basis for this claim is debatable. At this point, we should focus less attention on how to design carbon pricing policies, and more on whether carbon pricing is in fact a useful tool.²⁶ This is, to be sure, a normative question. But it can and should be informed by our expert knowledge about both the policy and politics of climate change.

Instead, we need to be asking more radical questions, like whether and how the redistribution of wealth and power can help promote decarbonization. Recent research shows the extreme inequality of carbon emissions by wealth: the bottom half of the population consumes less energy than the top 5 percent.²⁷ One long-haul flight produces more emissions in a day than residents of some nations generate in a year.²⁸

Wealth, particularly extreme wealth, is a key cause of climate change. Thus, policies to address inequality must be considered as an essential component of efforts to reduce emissions. Yet at least in international relations, there is limited work that considers climate change in the context of the broader frame of wealth inequality.²⁹ There is ample work that considers “climate finance”: the institutions that help the developing world with efforts at mitigating emissions and adapting to the effects of climate change (though some of this is outside of political science). While related, work on climate finance tends to focus on implementation, shying away from explicitly addressing inequality.³⁰

Plant a flag. In general, positivist social scientists (like myself) are more comfortable describing than prescribing, yet we must do both. Our analyses must first present and analyze problems, and do so in a rigorous fashion. Then we must move beyond describing various options and indicate which among them is preferable. We can have positivist inquiry in the service of normative goals.

As social scientists, we take as given that we must be transparent about our methods and data. So too must we be transparent about our normative assumptions and claims. Several tenets should guide our advocacy. First, we should not oversimplify. Experts understand the complexity of issues. Simplification is both important and necessary, but *oversimplification* is irresponsible. To the extent possible, this complexity should be communicated, so that others may make their own decisions about whether our positions are justified.

Second, to maintain credibility with fellow scholars, we should be explicit about our evaluative criteria. Indeed, normative assumptions are frequently buried in work about climate change (“efficiency is critical,” “growth must continue”). We do ourselves and others a service by being explicit about these normative criteria. One can choose to agree or disagree with our conclusions. However, providing clarity about how we arrive at conclusions, and the basis upon which we make recommendations, allows others to make their own assessments about the quality of our research, the veracity of our claims, and the validity of our proposals. This is critical for maintaining credibility within our discipline, to demonstrate that our work is more than a proclamation of what we *ought* to do, but what the evidence indicates about *why* we should.

Engage broadly. Finally, with proposals in hand, we must engage broadly. We should of course try to communicate our ideas to a lay audience, through op-eds, media interviews, and the like. But we should also consider how our work can help

those engaged in climate politics. And again, when we ask *radical* questions, we are more likely to supply politically relevant answers. Here, historians of science Naomi Oreskes and Geoffrey Supran's groundbreaking work on ExxonMobil is exemplary. Through historical analysis of Exxon's communications related to climate change, the authors show a definitive division between the firm's inward-facing and outward-facing communications. They found that "ExxonMobil contributed to advancing climate science – by way of its scientists' academic publications – but promoted doubt about it in advertorials."³¹ They conclude, in no uncertain terms, that Exxon deliberately misled the public about the causes and consequences of climate change. In addition, Oreskes' earlier work shows empirically that of almost one thousand peer-reviewed papers published between 1993 and 2003 on global climate change, not a single paper disagreed with the consensus position that human behavior induces climate change.³²

These papers both ask radical questions that get at the root of climate change politics. Each plants a flag: Exxon lied, and there *is* a scientific consensus about climate change. And they have broadly engaged the public and policy-makers. Each paper has been extensively covered in the media. Moreover, they have furnished important expert opinion for those making political arguments. And crucially, they have provided a much-needed rejoinder to other supposed experts who have been bankrolled by the fossil fuel industry.

Advocacy breeds credibility. Many who read this essay may worry that advocacy will jeopardize their tenure case or their standing in the discipline. To address this concern, it is important to consider – and distinguish among – the various audiences that academics address. Being credible to fellow scholars is distinct from being credible to students, or the public at large, or the activist community. I offer three responses to this objection, applicable to different audiences.

First, climate change is morally wrong. Any activist – scholarly or otherwise – who does not acknowledge this forcefully undermines her own credibility to students and fellow academics. We have a collective moral duty to address these injustices with all the tools at our disposal. Public policy scholar Eric Beinhocker has proclaimed himself to be "a carbon abolitionist." He invokes abolitionism as a way to build a movement to end the use of carbon, just as abolitionism ended the institution of slavery. He notes that "both systems are built on an immoral core, where one set of humans benefits by harming another."³³ It is our moral duty as human beings to end this injustice, even if that means sacrificing some degree of credibility in the minds of our colleagues.

Relatedly, this moral framing is also an argument against incrementalism. Incrementalism validates the status quo, which, in this case, is immoral. Thus, Beinhocker continues: "those who abolished slavery did not just want to reduce slave

numbers, free some slaves, make slave lives better, or have a slave-tax to reduce incentives for slave ownership.”³⁴ Similarly, we cannot just offset our carbon emissions, or slightly reduce them, since doing so will still condemn many to death or displacement.

Second, the notion of impartiality is a myth. The idea that social science is morally neutral is naive and, arguably, harmful to scholarly credibility. Even Herbert Simon, a pioneer in the study of rational decision-making, conceded that all decisions “must begin with an ethical premise that is taken as given.”³⁵ Economics professor Maximilian Kasy recently made the point more starkly: “Data . . . do not allow us to avoid value judgements, and do not relieve us from taking sides in distributional conflicts.”³⁶ We must make assumptions in our work, and we should not suggest otherwise. Our biases – whether conscious or not – influence the questions we ask, at the very least. To assume that impartiality is the opposite of advocacy is giving ourselves too much credit. Reminding fellow scholars of the myth of impartiality can help address credibility concerns.

Third, we delude ourselves to think that reasoned analysis will dislodge the powerful. We have brought a knife to a gun fight. To stubbornly insist that the truth will prevail or that we must simply “speak truth to power” ignores four decades of climate inaction. Such an approach overestimates our authority and thus undermines our credibility.

Climate change is deeply polarizing in many developed nations. Research has shown that in the United States, views about climate change correlate strongly with party affiliation.³⁷ This in turn implies that people on both ends of the political spectrum engage in motivated reasoning to justify their beliefs about climate change, discounting information that does not align with their beliefs.³⁸ Quite simply, this means that “impartial” analyses of climate change will not change peoples’ minds, at least not in the United States. (And some evidence suggests that similar trends, though less pronounced, exist elsewhere.) By remaining above the fray, we render ourselves irrelevant. Our sharp knives matter little when opponents wield automatic weapons.³⁹

There is another reason academics should take the role of advocate seriously: it is part of our job. We are not simply experts; we are also teachers. First and foremost, we teach our students, and we have a responsibility to help them understand the climate crisis, which will surely have a material impact on their lives. Helping them understand the real political-economic stakes of climate change can help galvanize new publics to engage in politics across borders.⁴⁰

I take particular pride in helping interested students find career paths in climate policy and social justice. One of my proudest achievements as a teacher was helping a student understand that he had many postcollege options beyond joining the military, which was his initial plan. I explained to him frankly and per-

sonally my own objections: the military is a terrifying source of human suffering and environmental destruction. I arranged for him to speak with friends and colleagues who had served in the military, as well as those in the legal profession (he was considering law school). He currently works as a data analyst for a labor union, and has plans to attend graduate school to study sustainable transportation. Watching his career path unfold has served as a powerful reminder of how listening and providing information to students can help them see the world differently. I am constantly heartened by how many are willing to take their anger and fear and channel it into productive activities.

Second, I have tried to mentor junior faculty by modeling engaged scholarship and offering support to younger scholars trying to do the same. I see this as an act of solidarity with fellow scholar-advocates – helping them get published and valorizing, whenever possible, the “unconventional” forms of scholarship in which they engage.

Third, public engagement should be recognized as part of our role as teachers. Scholars speak to each other, often in theories, formulae, or other languages that are not readily understood by a lay audience. Peer review is the foundation of evaluation; publication in highly ranked peer-reviewed journals is an important signal of success. But evidence shows a significant gender gap in citations in international relations.⁴¹ Non-peer-reviewed publications – op-eds, commentaries, news appearances – are not counted seriously as part of a scholar’s productivity. But this is wrongheaded. It indicates that we have forgotten our *real* role as teachers – making complex ideas readily digestible for a lay audience – which is, perhaps, also the *most difficult* kind of teaching. Participating in public discussions should be acknowledged not only as a public service, but also as evidence of excellence in teaching.

Being an advocate and an expert should not be mutually exclusive. Rather, as educators and scholars, it is our responsibility to participate in public discussions. Indeed, the University of Toronto, where I am on the faculty, describes its mission as follows:

The University of Toronto is dedicated to fostering an academic community in which the learning and scholarship of every member may flourish, with vigilant protection for individual human rights, and a resolute commitment to the principles of equal opportunity, equity and justice.⁴²

To me, a resolute commitment to the principles of equity and justice means engaging and teaching beyond the academy in ways that indicate what we ought to do about climate change, rather than simply explaining the available options. The basic motivation for our work is to make sense of the challenges we face as humans. Our job is to understand, explain, and broadcast those challenges to everyone, and those core tasks are what we should value as academics. When we for-

get this, our research and teaching suffer. We can inform our students, the public, and those engaging in policy-making and political action. In this latter category, in particular, we should ask radical questions and move beyond incremental proposals.

These proposals will make many academics uncomfortable. And they should. They make me uncomfortable – hence this essay. We are no longer bystanders in the climate crisis; we all have skin in the game that is climate politics, whether we are aware of it or not. Choosing not to have a view, in the name of preserving our expertise, is an abdication of our responsibility. That abdication works in favor of powerful interests, and against those seeking to reorganize power relations. There are stakes to the political phenomena we study. We have a professional responsibility to act.

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A Conversation

Nancy L. Rosenblum & Rafe Pomerance

“The fate of Greenland is the fate of Miami.”

Rafe Pomerance has been called “the original climate change warrior.” He was profiled in Nathaniel Rich’s 2018 *New York Times Magazine* article and subsequent book, *Losing Earth*. At the moment when much of the science was known but there was no awareness in political circles, Pomerance was crucial in shaping recognition by government officials, policy-makers, and the public that climate change is a crisis. In two conversations, on May 10 and August 5, 2019, we talk about his path into climate work; the sequence of his experiences as an advocate, strategist, organizer, and negotiator; his work with Arctic 21 and ReThink Energy Florida; his political assessment of the point to which we have come; and his experience as a “witnessing professional.”

NANCY L. ROSENBLUM: Until fall of 2019 you were chairman of Arctic 21, a network of organizations communicating “the unraveling of the Arctic as a result of climate change” to policy-makers and the public. Let’s start here: why did you choose that organization?

RAFE POMERANCE: Our one-liner is, “The fate of Greenland is the fate of Miami.” The fate of Greenland is the fate of many coastal cities because melting from continuous warming could ultimately lead to twenty feet of sea level rise. We’re not going to see all that in the short term, but we’re already seeing a significant amount. Greenland, the Arctic high-latitude glaciers, Antarctica, and thermal expansion of the oceans are the major contributors to sea level rise, and your (Rosenblum’s) house in North Truro (Cape Cod) is experiencing that, partly due to Greenland. So the interest of the United States is bound up with the fate of Greenland.

A question frames our work in Arctic 21: what is the future state of the Arctic? Or, what is the Arctic we must have to sustain the global climate system? These are different versions of the same question, and governments have to answer the question, or should. Governments have to figure out what is required if we’re going to have any chance of achieving climate sustainability. Remember when the earth is 2 degrees Celsius warmer than pre-industrial times, which is coming up on

us, the Arctic will be about 5 degrees Celsius warmer: that's two-and-a-half times the earth's global average. The question, again, is what do scenarios of the future look like? And how are governments going to decide where we end up? Because one way or another, they must decide.

NR: Where does the U.S. government stand today on the Arctic?

RP: This is an interesting week to talk about that (May 10, 2019) because it was one of the worst weeks ever for the U.S. government with regard to the Arctic. Secretary of State Mike Pompeo went, as he should, to a biannual meeting of the foreign ministers of the eight Arctic countries (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States). They got together to approve a declaration about what they've done, what they're going to do, what their focus should be. The United States negotiated and then refused to accept a draft declaration that included attention to climate change as an element of the Council's program.

The only statement Pompeo made related to climate was that as we lose sea ice, ship channels are opening up. He didn't talk about the other aspects of sea ice, or any other aspect of the Arctic that is falling apart. He wouldn't acknowledge climate change, and he blocked agreement on the declaration because the United States wouldn't accept any reference to warming – a reference other governments had to have in their declaration of purpose.

Pompeo instead made speeches attacking China and Russia as military and economic competitors. This performance was arrogant and inappropriate. To talk about competition is one thing, but to do it at the Arctic Council, which is a multilateral organization focused on the environment that has deliberately kept broader political issues at bay is another. He missed the point. The point is that the unraveling of the Arctic is a threat to U.S. national interests.

NR: You made the striking statement: “The fate of Greenland is the fate of Miami.” What led you to that realization? This statement is one of many examples of you speaking eloquently as a witness.

RP: There are two parts to the answer. One is the scientific part: Greenland is the largest sources of sea level rise today. The second part is political: Florida is the potential epicenter of climate politics. Florida is the most important purple state, a competitive swing state that could go either Republican or Democratic in presidential elections. It is existentially threatened by sea level rise. So if you can make the connection between the Arctic and Florida, you can make a powerful case for action.

NR: You've drawn the connection between your involvement with Arctic 21 and ReThink Energy Florida, and we will come back to that. First, let's trace your path

into climate work. It's of interest because your personal story and your involvement in climate politics proceeded together. You were a young environmentalist – how did you first become interested in the environment?

RP: That's a good question. I grew up in Cos Cob, Connecticut, on a property purchased by my grandfather. I walked in the woods all the time, which included a lake where I skated and played hockey. My mother was heavily involved in the nuclear test ban and nonproliferation treaties, so there was that influence. My father was an architect, a planner; there was that influence, too. My sister was involved in local conservation. My brother was a mountaineer. My aunt was a conservation writer. She had a home in Martha's Vineyard and wrote a couple of fine books on coastal issues.

Another element was that my parents were political. They were members of the Democratic Party and were donors. They went to events and occasionally they'd take me along. So I learned something about politics, and of course I was in college during the Vietnam War. I became part of the antiwar movement, which was another education in politics.

NR: These influences came from home. What about your professional path? Was Friends of the Earth, where you became president, your first job after college?

RP: No. When I got out of school, I was a VISTA volunteer in Virginia learning how to be a community organizer. I did welfare rights organizing. We were organizing poor people to claim what was rightfully theirs under local welfare regulations. There was funding that should have been flowing to low-income communities but wasn't. So we tried to simplify access and to make welfare departments enforce the law. I learned organizing skills doing that.

NR: How did you move from that to Friends of the Earth?

RP: Well, I moved to Washington, because I wanted to lobby for the National Welfare Rights Organization.

NR: Let's just pause on this. I've never heard anyone say they set out to become a lobbyist.

RP: I was interested in how government worked and in trying to influence things. It's hard to recall exactly, but *lobbyist* has become such a pejorative term. I wanted to get into the action. I went from welfare rights to a group called the Urban Environment Conference (UEC), which was a coalition of labor, environmental, and poor people's organizations. (I met my wife Lenore doing this work; we were codirectors of the UEC.) The group was set up by Phil Hart, the former senator from Michigan. The United Auto Workers was very green at the time, and Hart's staff helped organize the coalition of unions, poor people's organizations like Na-

tional Welfare Rights and the National Tenants Organization, and environmental groups like the Wilderness Society. It was a coalition trying to find common ground.

One area of common ground was air pollution. We spun off a really effective coalition called the National Clean Air Coalition that operated from the early 1970s to the early 1990s. It contributed enormously to the environmental success of Congress's amendments to the Clean Air Act of 1970. We might not have had a Clean Air Act with integrity without that coalition.

NR: Another contributor to this volume, Patrick Kinney, also entered climate work through his study of air pollution.

RP: That was my path, yes, but at this point I was not yet into climate work. My transition was sudden. After the Clean Air Act amendments of 1977 were added, I did research with the Friends of the Earth on acid rain. I ran across an EPA report on the environmental impact of coal in which there was a reference to the potential that coal use could warm the planet. I was shocked. I said to myself, "This can't happen!" I stood up, walked out of my office, showed the report to a colleague, Betsy Agle, and said something like: "This must be the whole banana."

A few days later, Betsy brought an article into the office from what I think was the *Rocky Mountain News*. It was a story about geophysicist Gordon MacDonald's speech on the effects of increased carbon dioxide. Gordon had just completed a turn chairing a committee with JASON, the elite independent advisory group of geophysicists that consulted on science and technology for the U.S. government. Gordon was special in that he understood the bridge between science and policy. He understood the need to engage policy-makers. He had served in a policy capacity in the Nixon administration as one of the first members of the Council on Environmental Quality. Right away I called him up and asked if I could come to see him. I went with two colleagues to his office at the MITRE Corporation. We spent two hours together. He explained the whole thing to us.

NR: MacDonald was a mentor to you. What did you learn from him in a personal way?

RP: Gordon was a fascinating person with a great sense of humor, very smart politically as well as scientifically. He loved to eat at French restaurants; we had a special place we'd go to regularly for lunch. He was always very patient with me, explaining the different pieces of the climate problem. I think what he saw in me was somebody who could be helpful, and he was willing to take the time to lay it all out. I became interested in the problem and he was the credible source. He was necessary to everything I did at that time.

NR: MacDonald was crucial to your entry into climate politics, then. What was the first step?

RP: I said to him, “Okay, if I set up briefings, will you do them?” And Gordon was all for it. He had no problem spending time talking to policy-makers, whereas some scientists have no experience with policy.

NR: So you had to set up the venues for him?

RP: You put your finger on what was a critical point: there was nobody out there systematically connecting science to policy. Despite all the years of scientists publishing this report, that report, here and there, there was no systematic effort to make climate a public issue.

The fact that at that moment, through my work with Gordon MacDonald, it might be possible to put climate on the agenda is critical, because it actually needed to have been on the agenda decades earlier. In 1965, oceanographer Roger Revelle and others had produced a report for Lyndon Johnson on carbon dioxide and global warming, yet it did not become a central issue. Remember, I worked on the Clean Air Act for seven years and had never heard about global warming. You might think that I had the wrong education; I was not a scientist. But not so. Nobody brought it up – nobody in the administration, nobody on Capitol Hill, none of the expert witnesses – I never remember hearing about it.

NR: This is another time when you realized something important that no one talked about and no one was taking on. So you assigned yourself this task. I see that you had respect for your own mind – enough to take stands – even at a young age. You realized that you did not know enough to be an authority, but you thought you could do something. What enabled you to confidently recognize the importance of climate change and plunge into action?

RP: It wasn't as though I hadn't had a lot of experience on Capitol Hill. I had spent the last seven years or so working on the Clean Air Act and other issues, so I knew something about the process, something about the issues. A lobbyist is somebody who tries in the best sense to convince other people of the merits of their position through argument and political pressure. What I did with Gordon, essentially, is engage in a process of dialogue with important people. That was not a problem for me: the issue was so compelling, and Gordon was so articulate and credible, that taking that step was easy. I had an authority behind me. Without that, I could not have successfully gone around convincing people that climate demanded attention.

NR: In *Losing Earth*, Rich reports that the decade from 1979 to 1989 was the moment when a massive effort at securing domestic and global commitments to control emissions seemed inevitable. Did you feel that way at the time?

RP: No. I don't think so. There was the possibility of getting started, though. We saw our goal as getting targets and timetables into national policy and international agreements. We worked toward getting governments to commit to hitting certain emission targets over certain timescales. That would have been the beginning of a major step toward a solution. We still don't have that commitment in the United States.

NR: At the time, you did not see the decade as a pivotal moment, but you did see the need for political action. You pushed for clear targets for reducing greenhouse gas emissions. As a witness, you had a good tactical sense for political steps and even dramatics.

RP: That's my job. The important step was taken at a 1988 international conference in Toronto, "Our Changing Atmosphere: Implications for Global Security." It came after the congressional hearing that Colorado Senator Tim Wirth chaired, the same hearing at which Jim Hansen declared that the global temperature record was outside natural variability. The conference occurred within a month of Hansen's testimony, during that very hot summer with forest fires burning, and I decided somebody had to start talking about making carbon dioxide reductions. I actually made a decision. Nobody was talking about it, somebody had to talk about it, so I decided I'll talk about it. That's actually what happened. I had a close working relationship with Tim Wirth's staff and proposed that they consider putting a target for reduction of greenhouse gas emissions in a speech he was giving in Toronto, and Wirth, who was a great leader, did. That was a big "first" by a major politician. The conference embraced the target; they decided it was doable. I think it was a 20 percent reduction by 2005.

Whether that was the right number, the point is, it was directional. It had the good effect of starting that debate and helping to trigger momentum on emission reductions.

NR: I am getting a picture of how you built your own body of knowledge and sense of possible solutions. You're doing this as you go along. In retrospect, then, was 1979 to 1989 a crucial decade?

RP: In that decade, a couple of things happened. The issue emerged from the scientific realm and entered into the policy arena. In the twelve years from 1979 to 1991, we went from nowhere to the 1992 United Nations Framework Convention on Climate Change. The Senate gave its advice and consent to the Framework Convention: ninety-two to zero. The weakness in the treaty was that there were no hard commitments to reduce emissions.

NR: Was the failure to proceed an institutional failure or a failure of individuals to comprehend the problem and to act?

RP: Both. Remember, this issue was new to the United States, and we're talking about the gigantic task of replacing the fossil fuel based energy system with clean energy! It's the largest task ever considered by governments. So to think that everybody is going to jump to it, including all the special interests, is mistaken. Few people understood the problem, except for some of the big companies like Exxon. They knew a lot. In that decade, they knew how formidable the challenge was and how much risk there was for the planet, but they soon switched to a strategy of denial and misrepresentation. Others have studied this history carefully.

In any case, at that point I was not pinpointing fossil fuel companies as the enemy. I was focused on the Bush administration. As we approached the finalization of international negotiations, some combination of companies and key people in the administration got together and argued against targets. And some negotiators who wanted a treaty were also dissuaded because they thought the effort would fail if targets were included. All this prevented the United States from doing anything really meaningful. If John Sununu, who was an MIT-trained engineer and President George H.W. Bush's chief of staff, had understood climate science, he might have taken the opposite position from the one he took, which was skepticism and obstruction.

To my mind, he represents a type of very smart but ill-informed scientist or engineer who thinks he knows better than all the scientists who actually study the problem. He got it wrong, and that had consequences.

There's more to the story. James Baker, who was a powerful secretary of state, could have been a counter to Sununu, but he dropped out of the conversation. He just said, "Well I have a conflict of interest, so I am not going to deal with this anymore." He recused himself from any involvement in the development of climate policy because, he claimed, of his work with the oil industry. Baker could have been a formidable advocate. In 1989, a letter was delivered to him from eight members of the Foreign Relations Committee: four Democrats and four Republicans, if I remember correctly. After that, Baker made an important speech, perhaps his first remarks on the subject, advocating what he called a "no regrets strategy": that it was prudent to take certain actions immediately, and that we could not afford to wait until all the uncertainties were resolved. He recommended measures like energy efficiency and planting trees. On the one hand, his recommendations did not push for a firm commitment to spend government money on the problem. On the other hand, it acknowledged the issue. No denialist would have ever said that. And then he recused himself.

NR: How did you feel about his withdrawal?

RP: James Baker's recusal – why he did it, its impact – is a good issue for historians to study. The whole episode underscores my understanding that within the structural aspects of history, people make a difference. Structures change because of people. It's interesting to note that Baker is now part of an organization, the Climate Leadership Council, publicly advocating for a carbon tax.

NR: Let's bring your story forward to the present. Nathaniel Rich observed that all of the conversations taking place in the 1970s are still taking place. Yet there are also new conversations. What changes strike you as crucial?

RP: There has been a total transformation in the media coverage of the issue and a huge change in public attitudes. Then there is what appears to be an important awakening of young people; it's not that they weren't awake earlier, but now they are more organized, more vocal. That's very important because this is a multi-generational issue. Their voice is critical and deserves a place at the center of climate action because it's their lives and their children's lives that are at stake – including my children, grandchildren, and my grandchildren's children. So that's another shift. One more thing: we are at a crucial moment in partisan terms because the Republican Party as a whole is an obstacle to progress. Generally speaking, the U.S. Congress is the problem in the world, and within it, the Republican Party is the problem.

NR: Say more about these developments from your special vantage point. The media has clearly taken climate change up, and you've been working on that throughout your career.

RP: I am trying to think what actually led to this transformation in the media. Many people in different organizations have been working on the media aspects of the crisis. Every environmental group has its communications staff, and the scientific community publishes reports all the time, but finally now the press appreciates that this issue is upon us. I think that Rich's article "Losing Earth" had an impact because *The New York Times Magazine* decided to devote the entire issue to the history of how we got to this point. The publication was a signal of the reality and urgency of climate change. It came forty years after the big report of 1979, the Charney Report of the Ad Hoc Study Group on Carbon Dioxide and Climate, which had accurately assessed the effect of carbon dioxide on global warming.

NR: Is public awareness also spurred by the fact that we're experiencing the impact of climate change? Forty years ago, it seemed hypothetical and far off. Today we see its effects, and our catalog of disasters is growing rapidly.

RP: I think so. The impact is undeniable. The climate system has begun to respond to what the scientists call "forcing." The term indicates the amount of additional warming resulting from increases in the concentration of greenhouse gases. The

oceans are warming. The atmosphere is warming. We're losing glaciers. We're losing sea ice. More than half of the world's coral reefs, including large portions of the Great Barrier Reef, are dead from bleaching caused by the heating of the ocean. An early biological signal came from the warming of the ocean, which we started to pick up in the 1980s. Jim Hansen's 1988 congressional testimony was another moment of awareness: the surface temperature record had exceeded natural variability. That was a signal. It goes on and on as more and more signals are picked up, making the whole case more convincing.

NR: We now have organizations and advocacy groups, we have mass movements with marches and protests, even civil disobedience. What's your sense of the significance of this organizing activity?

RP: I think it's important. It's a way to project the opinions of a large number of citizens into the policy-making process. Take the Natural Resources Defense Council or Sierra Club or Union of Concerned Scientists: they all have representation in Congress, and they have members back in the states who pressure their congressional representatives. So they're a critical element in trying to achieve results. Still, they're like everybody else: they don't know (in my opinion, none of us do) what is the right political judgment at the right moment. They can make mistakes.

NR: What kind of mistakes?

RP: Well, you can overreach. I was part of an effort to design a BTU tax (British thermal unit of heat) that Bill Clinton and Al Gore had proposed very early on. If you tax energy based on BTUs, you get something that works a lot like a carbon tax, without calling it that. The BTU tax passed the House of Representatives but went down in the Senate. The Democrats took a thrashing in the next congressional election, in part because of this issue. The Republicans just made hay, accusing the Democrats of wanting to raise energy prices. They did the same thing with President Obama and the Waxman-Markey Bill to promote a clean energy economy. Anything that is a direct form of energy pricing has to be done on a bipartisan basis, otherwise the Republicans will try to eat the Democrats' lunch.

Maybe it's just not possible anymore. Senate Majority Leader Mitch McConnell is going after the Green New Deal. Why? Because he thinks it too is politically damaging for Democrats. The plan makes a host of claims about what it is going to do, from guaranteeing jobs for all to narrowing the racial wage gap to retirement security. There has been a pretty big debate within the climate community about whether the Green New Deal is going to help or hurt.

NR: What do you think?

RP: I tend to think it helps because it seemed to have a galvanizing effect on the public, with the youth, and on Capitol Hill. It seemed to dramatically increase attention and motivation. We'll see. The Green New Deal may or may not help in terms of the electoral map. In Florida, for example, which is a pivotal place, the case is better argued from the standpoint of the effect of sea level rise on the state.

NR: That brings us back to Florida. You are involved with ReThink Energy Florida, raising awareness of the impact of sea level rise in that very vulnerable state. You see Florida as the linchpin for addressing climate change in the United States. Why?

RP: Yes, in a way it is the linchpin. In my more grandiose moments, I'd make a prediction that sea level rise will decide the 2020 election. It's not going to decide the election based on its impact in North Truro, Massachusetts, but it could in Miami, Tampa, and Jacksonville. The key is that Florida is the most important electoral state in the country. If Florida moves green, so to speak, just a little bit, President Trump could lose Florida and lose the election. He has to win Florida. The theory that I've been operating on for a number of years is that if Florida – which faces existential issues from sea level rise and the increasing power of hurricanes – wakes up, it will shift politics because the Republicans will have to take action.

NR: For some time now, Florida has been engaging in local climate adaptation measures. Can this be done without acknowledging climate change?

RP: Former Florida Governor, now Senator, Rick Scott, refused to acknowledge it. Nor did he assist in local adaptation measures. But leading counties acknowledged the climate change problem, particularly in southeast Florida: Palm Beach, Broward, Miami, Dade, and Monroe. They formed the Southeast Florida Compact, and the movement toward multicounty organizations has been spreading in the state. The three largest newspapers in South Florida – *Miami Herald*, *The Palm Beach Post*, and *Orlando Sentinel* – and WLRN, the PBS station, have formed a collaborative and, with about two dozen smaller local newspapers and public radio stations, publish a joint editorial page on the web called *The Invading Sea*. Why? Because when they started, they declared that sea level rise is the most important issue facing Florida in the twenty-first century.

Now some members of Florida's congressional delegation and Governor Ron DeSantis have pulled back from Scott's intransigence. DeSantis did an about-face when he took office. He has said climate change is real, and that's huge (though we will see if he goes ahead with state-level efforts). He's appointed someone to be in charge of adaptation and resilience planning. He's appointed a good science adviser. My colleagues there are pleased with the shift because they're not fighting against denialism as they did with Scott. At the same time, there is growing skepti-

cism that DeSantis will deliver. Still, once you've acknowledged the issue, you've taken a big step.

NR: Some people think climate adaptation diverts attention from the vital business of mitigation. Another view is that when adaptation measures are going on right around you at home, and your street is being elevated to accommodate flooding, it raises awareness of the need for mitigation. Do you think it works that way?

RP: Well, I think you're not going to stop people from working on adaptation. They've got to cope with what's coming at them. Doing so will lower the costs and impacts of climate change. The problem with adaptation in the long run is, what are you adapting to? What climate system are you adapting to? One or two degrees warmer or five degrees warmer? You know, there may be no point in adapting to a climate that's five degrees warmer. If you live near a coastline, you're going to have to move; even two degrees of warming will probably mean you're going to have to move. The climate is now transient, it's changing all the time. There is no equilibrium state anymore. So what is it you're adapting to?

NR: Do you see a constructive connection between adaptation and mitigation policy?

RP: Yes, because when you start trying to figure out what future you have to adapt to, you are forced to consider reducing emissions. It's an "oh my God" sort of moment: if we follow X scenario or Y scenario, the differences in what we will have to do are huge. There's a logic to the dynamic interaction of adaptation and mitigation because if you're trying to plan for security or resiliency, you've got to consider what emission scenario you are planning for.

NR: You've been involved in international negotiations, including a period as deputy assistant secretary of state for environment and development and as a negotiator for the Kyoto Protocol. What did you learn from your experience that negotiators today need to know?

RP: I was very involved in the lead-up to Kyoto, and I learned a lot from that experience. It was extremely stressful for me because I had a personal connection to the problem. I had personal feelings about it. Some of my colleagues were long-term professional negotiators who weren't as deeply into the science as I was. They had more distance.

In some of those negotiating sessions, I remember saying to myself: we're negotiating the future of the planet and at the same time the future of the global economy. That's what was going on, implicitly, in the room. Those were the stakes. You have to deal with the build-up of greenhouse gases that control the fate of the earth, its climate system. At the same time, you have to substitute an entirely

new energy system for powering the world economy. That's the largest task ever invented for government (though it may be second in importance to controlling nuclear weapons: that is, never using nuclear weapons).

I didn't have any experience with multilateral negotiations when I started, so I had to learn very quickly. I've concluded that we, the United States, can no longer go into a multilateral negotiation unless Congress has approved legislation that would allow us to implement what we negotiate. How do you negotiate in good faith when you can only hope that your government will pass legislation to implement the agreement? It was a terrible spot to be in. That's even true for the Paris Agreement, which has voluntary targets. So we have a problem negotiating anything unless it's clear that the political system supports it. If you were appointed secretary of state or assistant secretary for the Bureau of Oceans and International Environmental and Scientific Affairs, what are you going to do? You can't come up with a scheme to save the planet unless you have the authority back home, unless the Congress has told you "yes, we will do that." That's a huge lesson and a challenge for U.S. negotiators.

The second lesson is how tough it is to come up with an agreed target of reductions because, of course, every country is different. The Paris Agreement reflects everything we learned from the Framework Convention in Rio in 1992 through all the subsequent attempts to get an agreement. Paris is a voluntary accord based on each country's own judgment, and because the targets are self-imposed, it was possible to get everybody in. Developing countries joined. China joined. Then you're reliant – as you are in anything – on domestic political commitments to achieve those numbers.

We're still waiting for the United States to step up and understand that the fate of our country lies in dealing with emissions. We still have no political consensus on that. Some of us understand what's required while others don't, or just don't think it's worth acting on.

NR: So the distributive question, the international justice question, is central to negotiations and to getting an inclusive agreement.

RP: In the 1992 United Nations Framework Convention on Climate Change that committed countries to reduce greenhouse gas emissions, and that was ratified by the Senate, developing countries basically signed up to do nothing. It was the job of twenty developed countries to act first. The same thing happened with the Kyoto Protocol, which acknowledged countries' different capacities and responsibilities for addressing global warming. That was a strike against the agreement, given U.S. politics, and it was never submitted to the Senate for its advice and consent. But President Obama was committed to an inclusive Paris Agreement, and his di-

plomacy – especially with China’s President Xi – resulted in two hundred nations signing on to voluntary targets for reducing emissions. Yet President Trump abandoned it despite the fact that it was all-inclusive and voluntary.

NR: Let’s talk a bit more about mitigation policy. What has influenced your thinking?

RP: I talk to experts. On this issue, a lot of economists base their assessments on the most efficient policy. I made my judgments, leaving aside the politics of any particular measure for a moment, after many conversations with economists: mostly, Robert Repetto at the World Resources Institute; Roger Dower, who came to the World Resources Institute from the Congressional Budget Office; Dick Morgenstern and Ray Kopp, who were at Resources for the Future; and Adele Morris at Brookings. Generally, they were all carbon tax proponents.

The best, most efficient policy mechanism for reducing emissions is a carbon tax. But the obstacles are significant. To get there, you need Republicans on board. You have to take care of the distributional issues by using the revenues in a certain way. You have to take care of the trade issues. You have to take care of those interests, let’s say energy-producing regions, that could get hit. So you want to design a policy that acknowledges transitional costs and attends to the impact of the tax on low-income communities. We’ve learned a lot about these questions of distributive justice over the years, and people are designing comprehensive packages of policies to make the impact equitable.

I think we have to bail out some of the energy producing, fossil fuel producing regions of the country. I recall a speech I gave in Charleston, West Virginia, maybe twenty years ago. I started out by acknowledging the role that West Virginia had played in building the country’s energy system. We have to acknowledge that. We have to understand people’s vulnerabilities.

In my book, the fastest solution to the equity issue is low-cost clean energy. It has to be cheap enough for developing countries to embrace solar or wind or nuclear – whatever it might be that out-competes coal and natural gas. If you can lower the cost of substitutes enough, emissions will drop faster. That’s where innovation comes in and why investment in research and development is so important.

NR: What about the view that nuclear power is the best answer?

RP: Well, that’s probably hugely expensive, absent a carbon tax. With a tax, the economics would work themselves out, in theory. If you impose a carbon tax, the winner tends to be the low-cost option. So if coal and gas become much more expensive, nuclear becomes relatively cheaper. I would say that in that scenario, if nuclear is low-cost, then fine. In the context of the dire risks of the build-up of

carbon dioxide, I'm not overly worried about nuclear power. We need all hands on deck to avoid the worst. I wouldn't take that option off the table unless there's good reason to do so, like safety or proliferation.

Do I have reservations? Determining whether nuclear power is "safe" is up to the regulatory process. I'm no expert on nuclear power safety, or on disposal, or on the connection to nuclear proliferation. Those are all important problems. The question becomes, what can nuclear power contribute to addressing the climate problem and is it worth the risk? If it's too expensive compared with solar and wind and even coal that has had the carbon pulled out, then why go there? But if it isn't too expensive then you have to evaluate it on these other grounds. I am not a *no* on nuclear power.

NR: Often some energy source, nuclear, for example, is described as transitional. Is that a helpful way of thinking?

RP: Some people say natural gas is a transitional fuel, but that's getting less popular because methane leakage and gas still produce carbon dioxide. Geoengineering may be a transitional strategy, not forever. It's essential that while society is implementing geoengineering, it is also eliminating carbon as a source of emissions and even pulling it out of the atmosphere. It may take a long time, but you can envision a point at which the temperature of the earth is either rising so slowly or is flat that you could stop. Now, that could be a long time from now; it could be a century. Transition is not short term.

NR: How did you get involved as an advocate of geoengineering research?

RP: I've spent some time supporting the establishment of a research program in the U.S. government. We don't have a research program on solar radiation management – reflecting some amount of inbound sunlight back out into space – and we need one. Even if we oppose geoengineering, we have to be able to point out its problems and explain why opposition is warranted, if it is. We may need to intervene in a planetary manner to cool the earth off in a hurry when no other tool is available.

NR: All along, in discussing your evolution as a climate activist, we've been talking about your emergence as a witnessing professional. Could you say more about that, both your view of yourself in that light, and your view of others around you? You worked closely with scientists who moved from their community of expert knowledge to public testimony and activism. What did you observe about others who were reticent about speaking out, and about professional constraints?

RP: I think there was a period when scientists were the voice of urgency. Urgency was implicit in the science. Initially they were the appropriate people to speak

to the issue, because they understood it and could lay out how it worked, what the consequences were, and so on. Then, in theory, policy-makers, diplomats, and everyone else would come to grips with it. In theory. Even if they are knowledgeable about policy, scientists risk losing credibility if they start to weigh in on policy because those discussions are always politicized. Sometimes it's better for them, even if they have an opinion, to withhold it.

There is a form of appropriate caution and a form of political caution. Scientists work in a world of peer reviewed literature, and there they exercise appropriate caution. They want to get it right. At the same time, some scientists become very active in policy areas where they don't have the credibility they do as scientists, and it's arguably counterproductive. It's a matter of doing it properly, arguing the case, and recognizing the risks.

The risks are real. Take Florida under Governor Scott when the word went out: "Thou shall not talk about or use the words climate change." Eventually many scientists in the state did speak out. In the Trump administration, people are keeping their heads down. The administration hasn't restrained experts at NOAA or NASA from talking about climate science, but they have tried to silence the EPA. And government has censored data that are used by the public; at a minimum, this is a failure of government's responsibility to educate.

NR: Scientists enter the history of the global climate crisis because their work is the basis for understanding where we are and where we are heading. You enter this history by providing a bridge from science to politics and policy. As a political strategist, you are not bound by the established norms of a licensed profession, such as law and medicine. Even so, have you experienced constraints on witnessing?

RP: I'll give you an example. Geoengineering has been a topic that has been unmentionable for a long time because of the fear that talking about it would dissuade people from reducing emissions, or that the risks would be too great. Geoengineering is not a new subject. I remember the testimony in 1987 of Wallace Broecker, one of the world's top geophysicists. He said that we may have to fly 747s with sulfur into the stratosphere to block sunlight. His testimony went nowhere; no one took notice. When John Holdren, Barack Obama's science adviser, was asked by an AP reporter at the end of an interview, "Are you in favor of doing geoengineering research?" Holdren responded, "Of course." Well, that became the lead of the story, and as I remember, the result was that Holdren was battered for it. Until the very end of the Obama administration, that was the risk of even mentioning geoengineering.

So in most settings, introducing a discussion of geoengineering requires gump-tion. Just recently I stood up at a National Academy of Sciences event, where a

speaker was talking about how to prevent the ice sheets in Greenland and Antarctica from melting, and I asked him why he didn't mention geoengineering. It took me years to stand up in public and ask that question because of fear of ridicule. And still eyes roll. Often scientists don't know anything about it, even though it's a relevant policy response. Political opinions about geoengineering tend to override the necessary policy and scientific debate.

I am an advocate for research. And the more time goes on, the more I can see that the odds of an intervention go up. We are already deeply committed to a massive warming of the earth – it is baked in – and if you don't cut the warming off, somehow, while you're getting emissions down, you lose the fight. A friend who is a paleoclimatologist sent me an email that read: "We're on our way to the Pliocene." The Pliocene was three million years ago, and the concentration of carbon dioxide then was the same as it is today, but the temperature and sea level were much higher. Given enough time, the planet will look like the Pliocene. Impacts take a long time to happen after concentrations of carbon dioxide have changed.

When I have to do something tough, I wear a bracelet given to me by my granddaughter. I use that to remind myself that I have to be outspoken. Unless there's some strategic reason not to speak out, I don't hold back, because this is about her.

NR: If an international agreement on targets for restricting carbon emissions and sticking to it is hard, imagine overseeing and enforcing an agreement on geoengineering.

RP: Everything is hard. That's no different. What we're dealing with here is an unprecedented effect of humanity on the planet. There is nothing like it. Nothing at this scale.

NR: My last question: We've all heard expressions of despair from climate scientists, from biologists who study species that are becoming extinct, for example, and many others who have been personally and professionally entrenched in studying the effects of climate change. What gives you courage, and what gives you hope?

RP: At this point, having courage is not a problem for me. I speak. I know what I think. I know that every time I speak out, my own voice, my own words evolve in responding to different issues. Shouldn't I be totally depressed? Yet I'm not. Does that have to do with the substance of the issue? Or in the end, perhaps it's a matter of personal disposition.

What gives me hope? The emergence of young people, if they get organized, is really, really, really important. They have a legitimate stake in this, more so than baby boomers like me. And the progress we're making on some technologies gives

me hope. The cost of solar and wind has come down. Also hopeful is the number of people involved in the issue. When I started, nobody had heard of the problem. Nobody was active. When I went around with Gordon MacDonald briefing people at high levels in the Carter administration, they had never heard of climate change. We started at zero. Well, look at us now. Everybody in the world knows about climate change. So is that progress? Let's hope.

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The Coral Is Not All Dead Yet

Carolyn Kormann

Reportage and essays are the first and most immediate way that citizens learn about climate change science, its causes and consequences, and the impacts that industry and consumerism have on ecosystems. For fifteen years, I have been reporting and writing stories on these topics. Growing up, I was drawn to the environment because I was fascinated by the diversity, the endless variety, of life on Earth. But early in my career, in my first reporting job for a newspaper in the Caribbean, I also saw the disastrous toll that contemporary civilization was taking on the natural world – specifically on coral reefs. And yet, the climate crisis was not widely reported as such in those days. That experience, and the dearth of mainstream climate reporting at the time, led me to seek out some of the leading thinkers on the subject, and made climate one of the central subjects of my work. Most often, in the field of journalism, the phrase “bearing witness” refers to war journalism, while my work, for years, had often felt like science translation, connection, and storytelling. But more recently, as the ecological and societal impacts of a changing climate have grown more extreme, widespread, and apparent, while greenhouse gas emissions continue to rise, climate journalism has, too, become a form of bearing witness.

When I was in the third grade, in 1991, I read about Biosphere 2 in a children’s magazine. The idea of a monumental, glass, sun-drenched structure, in a faraway desert landscape, containing miniature versions of seven biomes – rain forest, ocean with a coral reef, desert, savannah, mangroves, intensive agriculture, and human habitat – was thrilling. The experiment, in which eight adults were to live in the biosphere for two years, surviving alone on what they produced inside, seemed like my kind of paradise. It was a fantastical bubble, a child-sized planet, where you could go from desert to rainforest just by walking, where you could live safely in the paradox of contained wilderness, where you could study plants and animals, interact with the wild in controlled experiments, where you created your own world. Not that I could articulate those inclinations at the time.

The investor behind the experiment was interested in the technology of artificial, materially closed ecological systems, or vivariums, in order to find a way for people to live and thrive on other planets. There was a strong element of whimsy, even fantasy, among the adults involved, several of whom were not academ-

ic scientists, but came from a theater background. Many outside scientists were skeptical of the project, with good reason. I don't recall when I learned that things went wrong. But they did. There was infighting among the eight biospherians, they nearly ran out of oxygen, a few smuggled in food. Steve Bannon made an eleventh-hour appearance, to muck things up even further. I recently looked up what became of the place and found out that from the mid-1990s until 2003, Columbia University leased it. The University of Arizona took over the lease in 2007, finally buying the property in 2011. I was slightly amused to learn that both institutions have used the structure for scientific experiments: specifically, to study what happens to various ecosystems when carbon dioxide levels were raised inside the structure. In retrospect, my obsession with Biosphere 2 was the childish precursor to a future writing about climate change.

In the summer of 2005, not long after I graduated from college, in pursuit of wild places, I took my first reporting job with a biweekly newspaper in the Virgin Islands. A novelist who had been my writing professor and his wife, an artist who painted coral reefs onto silk, had left their home in Vermont and bought the paper the previous year. (They had lived in the islands when they were younger.) Two-thirds of St. John, the tiny island where the paper was located, was declared a national park in 1956. The population was small. The first night I arrived, I joined the newspapers' staff of misfits for an evening picnic in the park. In the darkness, the beach a cacophony of peepers, we went swimming, and the water glowed and sparkled, thick with phosphorescence, a sea of stars. It was the first time I had ever swum in tropical waters, the first time I was acquainted with bioluminescence. I was in heaven.

But not all was well. Later that week, I went snorkeling for the first time. It was beautiful, thrilling, but mainly because of the sea turtle I saw and followed, in a trance. The corals themselves did not look how I thought they would look, although I didn't want to admit it. There were some flashes of color – faded purples, pinks, and rusty oranges – and the fact of an underwater city, full of bright fish and architectural marvels, was mesmerizing. But most of the reefs looked gray, and were peeling or scabby. These were corals off an island that was mostly protected land, and nevertheless, they were dying. Within a month of my arrival, many of them had turned a ghostly white. A forest of elkhorn corals just off a popular beach called Hawksnest was particularly depressing. It reminded me of a boneyard, an X-ray, forgotten archaeological ruins.

Warm, calm water is ideal for bioluminescence, the light that unicellular organisms called dinoflagellates emit when moved or disturbed. But the water on my first night on island, I later learned, wasn't just warm. The ocean temperature that summer exceeded averages seen over the previous one hundred and fifty years. Prior to 2005, there had been no recorded instances of bleached elkhorn

coral – what I saw at Hawksnest Bay – in the region. The corals, stressed from the heat, expelled the algae that fed them and provided their color. The stress, and bleaching, made them more vulnerable to disease, including something called white pox. When coral reef bleaching is severe enough, the corals cannot recover, they succumb to disease and die. Ultimately, I later learned, 90 percent of that year’s coral in the Virgin Islands bleached and 60 percent died.

A young coral scientist on the island told me, according to the story I wrote at the time, “Warm water temperature certainly could be a factor in the spread of disease. We do see a spike in the summer months – the white pox is more frequent.” But no one called the bleaching-and-disease event global warming. (Climate change, the phrase, wasn’t in common usage yet.) And yet that was, undoubtedly, my first global warming story. In 2010, another bleaching-and-disease event, nearly as bad, occurred in the Caribbean, and, in 2015, a worldwide coral-bleaching event, which lasted through 2017, included the Caribbean among its victims. The documentary *Chasing Coral*, which was released in 2017, captured this event off the coast of Australia, in real time. They caught on camera, thanks to drones and underwater cameras, a phenomenon that had previously been little documented. The corals, right before they died, fluoresced, turning vivid shades of blue, purple, and yellow. One of the film’s narrators and producers said that the coral was producing a “chemical sunscreen to protect themselves from the heat.” He went on, “This is the most beautiful transformation in nature, the incredibly beautiful phase of death. This is going on and no one is noticing. And it feels as if it’s the coral saying, ‘Look at me. Please notice.’”¹

Looking back recently, I discovered that the 2005 bleaching event still remains the worst the Caribbean Sea has ever experienced. At the time, I thought that it seemed too coincidental that my short time in the Caribbean would overlap with a one-in-five-hundred-year event. Something else was going on. Maybe that kind of warming and coral bleaching was happening more often. At the end of that summer, I sat in a restaurant overlooking the ferry dock and watched, on TV, a monstrous spinning blob, Hurricane Katrina, bear down on New Orleans. Warmer air and seas can intensify hurricanes. Experts had already projected that global warming could lead to larger, more damaging storms. I knew these were individual events, but nevertheless, global warming – what had been an abstract concept to me up until that summer – now felt visceral, real. That Caribbean summer was a glimpse of what was to come. I had a subject.

A year later, in 2006, when I left St. John to move back to New York to attend graduate school, Al Gore’s *An Inconvenient Truth* was released. I read more on the subject, including *Field Notes from a Catastrophe* by Elizabeth Kolbert, which had been published in March of that year, and *The End of Nature* by Bill McKibben, which was published in 1989.² My master’s degree was through

two graduate schools at New York University: the journalism school (now the Arthur L. Carter Journalism Institute) and the Graduate School of Arts and Sciences' Latin American and Caribbean Studies program, which offered me a fellowship to pay for my studies. During my first spring semester, an environmental journalism course I took coincided with the publication of the Fourth Assessment Report from the United Nations Intergovernmental Panel on Climate Change (IPCC).³ It seemed, paradoxically, like climate change was the story of the day, and yet it still wasn't really mainstream, or widely discussed among most people I knew. That made me feel, even more, that it was a subject I wanted to cover. I wrote a story about the Earth Simulator, in Yokohama, Japan: at the time, it was one of the world's largest supercomputers and a center for climate modeling. (Since then, it has been replaced by Earth Simulator 2 and 3.) Despite the dying coral reefs, despite Hurricane Katrina, *projections* of how global warming would change the climate – *in the years and decades to come* – still formed the bulk of the IPCC's report. I was fascinated by the crystal-ball nature of climate computing. And yet, while projections can fill a news article, a story they do not make.

Cynthia Rosenzweig, one of the IPCC report's lead authors and a senior research scientist at NASA's Goddard Institute for Space Studies, came to speak to our class to highlight some of the findings. I don't remember any of what she discussed, apart from Bolivia. Glaciers in Bolivia. Until that point, I had never given much thought to alpine glaciers, especially not glaciers in South America, west of the Amazon. I had only started learning about the Andes, after taking a course with an anthropology professor who had spent decades living and writing about Bolivia. What Rosenzweig said, which especially got my attention, was that in this IPCC report, one of the notable changes from the previous report cycle (the IPCC releases new assessment reports every seven years) was that scientists had actually observed that the rate of melt and retreat among Andean glaciers had increased. These were not projections; the retreat was happening now. As the pioneering glaciologist Lonnie Thompson said, again and again, subtropical glacial retreat was, clearly, the canary in the coal mine of the changes to come.

I decided to go to the Andes to try and find a climate story. One of the challenges of writing about climate change – what other journalists and editors still, today, bemoan – has been that the drama is often set in the future. The stakes are abstracted. Great stories often tell us about things that happened in the past. We want to know the mistakes that people have made, and we want to know the outcome, the ending. We want to hear what already happened, not what might happen, to other people, down the road. Perhaps that is why the first entire issue that *The New York Times Magazine* devoted to climate change, published in August 2018, contained a story by Nathaniel Rich about the political *history* of climate policy, about how we (or, rather, people in power) understood everything they needed to understand, in 1979, about the coming calamity. And yet they did nothing. We

now know that this was largely due to the power of dark money, and the power of fossil fuel companies' spin machines, which some dedicated journalists and scholars, like Naomi Oreskes, writing in this issue of *Dædalus* and elsewhere, have so thoroughly and brilliantly revealed. The past is Wisdom shouting in the street, and it's riveting.

Back in 2007, a newspaper story could report the IPCC's alarming projections but would also be required to couch every future scenario in the language of possibility, of likelihood, not certainty. The journalistic tendency to report "both sides" when it came to climate science, creating a false equivalency between rigorous, widespread data, and small but powerful and well-financed factions of denialists, wasted a tragic amount of time. A recent study showed that from 1985 to 2014, "press releases opposing action to address climate change are about twice as likely to be cited in national newspapers as are press releases advocating for climate action."⁴ Still, in 2007, even with the most certain aspects of climate science, time seemed relatively abundant; most of the changes were in the future, and there were years enough to prepare, to reduce emissions, to adapt. And yet, this sort of thinking was dangerous. So I was drawn to those reports from the Andes, where the future was present, where scientists were willing to link glacial melt to anthropogenic global warming, where in the cool, thin air, the mountains, and the people who lived downstream from their icy peaks, told a story. The glaciers were already rapidly retreating, altering the landscape. Agriculture and hydroenergy were affected. The growing season and microclimate were changing, affecting farmers' crops. There would be the torrents of meltwater, coming down heavier and faster than before. Floods and landslides. But then the dry-season water supply would run out sooner. Eventually, without the glaciers, the water supply for the half-year-long dry season would be gone. The high-alpine indigenous communities were already struggling.

I started reaching out to glaciologists working in South America. I got a grant. But I still felt uncertain about where to go, a specific story on which to focus my project. As the summer approached, I grew increasingly anxious; the scientists I had contacted seemed plenty interesting, but I was worried that traveling with them to take glacier measurements might not be juicy enough. I was back to the problem of reporting a story about the future. (I have since learned that the bravery of scientists, collecting field data in remote, difficult landscapes, can be plenty rich for a story.) I also worried that it might be difficult to clearly demonstrate how glacial retreat was already affecting local communities. Then, at an afternoon party for graduate students, only a month and a half before I was set to depart, I started speaking with that anthropology professor, Thomas Abercrombie, about my research into melting Andean glaciers. He told me about a religious festival that honored El Señor de Quyllurit'i, or the God of the Snow Star, which took place over the course of the week surrounding the summer solstice, in the high moun-

tains of southern Peru. The festival originated in worship for the mountains' glaciers, in particular, the Quyllurit'i glacier, where the ice's spirits, the *apus*, resided. Dancers, all men, would camp on the glacier for the week. Different troops and clans would battle on the ice, then pray. Pilgrims would approach and climb the edges of the glacier to collect chunks of ice to carry back to their villages; the melt water was preserved as holy water for the year. But these rituals had become increasingly dangerous, as the glacier, a constant for centuries, was rapidly melting and retreating. I had a story.

The reporting was remarkable. The festival of Quyllurit'i was spectacular and beautiful and sad – a syncretic dreamscape. There were men in spectacled bear costumes – the *ukukus* – guarding the glacier from pilgrims who hoped to retrieve a small chunk of ice to take home; the removal of ice was now prohibited. There was a Catholic chapel, built on the exact site where, in the late eighteenth century, after Spanish colonizers had arrived, a White, well-dressed child named Manuel had mysteriously appeared and befriended a young indigenous shepherd named Mariano. When the little shepherd brought local Catholic officials to meet his friend, the boy emanated a bright white light, then transformed into a momentary vision of the crucified Jesus Christ. There were Peruvian alpine soldiers, watching to make sure no one fell into a crevasse. There were mixed ideas on global warming, although some people certainly knew that rich countries were to blame. The strangest aspect was, however, something I had not anticipated. In the valley, pilgrims were constructing fantasies, almost like dollhouses, out of the glacial erratics, gravel, and pebbles that covered the mountain slopes. One pebble might represent a flat-screen TV, another might represent a truck, another, a new house. Each family had their small, make-believe world, and they prayed for these things over the course of the pilgrimage. The tradition had developed over the preceding decades. A lot of it was fun and games: a playful part of a long, ritualized week. And yet the pebble world threw everything into relief. Reporting on climate change should require not just understanding and conveying the science, but understanding the culture of a place, the stories that a culture tells itself about itself, how historical and contemporary influences and oppressors change those stories. These stories would always be tied to a landscape, and a place, they would always, in a sense, be local. And yet the consequences of the suburban American culture of consumption were also clearly here, changing the landscape and the people. By the time I filed my story about the festival, I had read many anthropologists' descriptions of Quyllurit'i, and the disappearing glacier. None of them referred to climate change. But this quote, from the Australian archeologist V. Gordon Child, seemed to sum up what I had seen: "The environment to which a society actually adjusts itself is not the material environment that natural science can reconstruct and observe as an external object, but the society's collective representation of that environment – that is, part of its culture."⁵

In order to better fund the reporting trip to the Andes, I had applied for a new fellowship in environmental journalism, offered by Middlebury College, where I had attended undergrad. Bill McKibben, a Middlebury College scholar-in-residence, was the leader of the program. One night, at a retreat for the ten new fellows, in a cabin in Ripton, Vermont, he spoke about a group of undergraduate students with whom he was working to form a nonprofit climate organization. I remember him saying that the time for political action had come; he had been banging the drum with books and articles about climate change since the 1980s, and yet policies were not changing. The fossil fuel companies were as strong as ever. Atmospheric greenhouse gases continued their steady rise. The group had chosen a number for their name – the amount of atmospheric carbon dioxide, in parts per million, necessary to maintain a stable climate – so that its meaning would be universal: 350. (The current count is 413.22 parts per million.) McKibben’s ability to clearly articulate the existential threat that climate change posed, in 2007, had a significant influence on me. I admired the movement he was beginning. He also gave us, a crowd of young reporters, some advice. We were clearly there because we cared about the environment, about the natural world, about social justice. But even as he was moving into activism, he told us to stick with journalism. Activism was crucial, but our task, at this point in our lives, early in our careers, was to find and tell stories, to hold powerful interests accountable, to write the facts, to furnish proof that the climate was changing because of human activities. Nothing could be more powerful. (He also reminded us, with a laugh, that journalism is a quantity business.) The journalist Ross Gelbspan was another teacher and mentor during that retreat. At that point, he already had had a long career chronicling the deceptions of the fossil fuel industry and their political allies. In 1998, he published *The Heat Is On: The Climate Crisis, the Cover-Up, the Prescription* and, in 2004, he published *Boiling Point: How Politicians, Big Oil and Coal, Journalists, and Activists Have Fueled the Climate Crisis – And What We Can Do to Avert Disaster*.⁶ By late 2007, the facts were out there. We had to continue reporting them. (For anyone who has worked on climate change issues for a long time, it’s painful to look back.)

The following spring, I audited an introductory climate science course at Columbia University’s Earth Institute with a young Solomon Hsiang, who now runs the Global Policy Lab at Berkeley, investigating subjects like the economic consequences of climate change. He was, back then, an inspiring, brilliant teacher. He helped me to connect the dots on another story I had written while I was working in the Virgin Islands: about Saharan dust storms that traveled across the Atlantic, sometimes carrying insects, and fell across the Caribbean. Perhaps the changing climate, as well as land development, were fueling increased desertification on the edges of the Sahara, which then fueled larger dust-storm systems, which made their way to the Caribbean, leading to bad air quality and wildly high rates of asth-

ma on islands like Trinidad and Tobago. We were making some (okay, many) assumptions, and yet the conversation was thrilling, and has stuck with me ever since. I wanted to try to always find the connections between events, to see the whole of the moon. In writing about climate change, it was inevitable.

Over the next few years, I moved around a lot, took multiple jobs, kept writing. I wrote a novel, set partly in the future, about siblings who owned a cemetery on an island and watched it wash away over the course of their lives. I lived on Hatteras Island, in North Carolina, which has an old seafaring culture and will likely be underwater by the end of the century, and I lived in the high Colorado Rockies, where the pine beetle, which could now survive the winter, was destroying vast conifer forests. I eventually got a job as a fact checker at *The New Yorker*, which might be, apart from another stint working in a bookstore, the best job I've ever had. I learned so much about editing, writing, and how to parse the truth when uncertainty abounds. I was surrounded by smart, curious people who cared, obsessively, about getting it right. Soon, I started writing in my spare time for *newyorker.com*, sometimes about climate change. One of my first pieces, in 2013, was about climate change in fiction, the emerging genre of cli-fi, and how in no time, cli-fi would seem an anachronism, since every novel that described the world as it was would describe a world with a destabilized climate. "This liminal moment, when the signs are everywhere that the climate in which human civilization developed is gone," I wrote,

seems a natural subject for fiction, and a number of recent novels have grappled with it – Nathaniel Rich's 'Odds Against Tomorrow,' Barbara Kingsolver's 'Flight Behavior,' and Ian McEwan's 'Solar' among them. These books have been labelled 'cli-fi,' but chances are that the name won't stick. It makes the genre sound marginal, when, in fact, climate change is moving to the center of human experience.⁷

In 2014, I covered the New York City climate march, when three hundred thousand people took to the streets, representing a turning point in the global movement that Bill McKibben and 350.org had helped begin, back in Middlebury, Vermont, in 2007. Climate change still seemed to me the only story, and at last, there were signs of momentum. The Paris Agreement in 2015, the Keystone Pipeline defeat, Obama's Clean Power Plan: it was not enough, but it gave one hope. Renewable energy technology was rapidly advancing, costs were plummeting. There was great promise that the leaders of the world could and would transform the global energy economy. Then came November 8, 2016.

Since Donald Trump was elected, I have written a lot of climate stories. I became a staff writer at *The New Yorker* in 2018. Until recently, for most of my career, I never thought of the work I did as witnessing. Most often, in the field of journalism, the phrase – *bearing witness* – refers to war journalism, to docu-

menting atrocities, particularly for photojournalists. My work, instead, has often felt like translation and connection. The translation of climate science for the general public, and the connection of that science to places, particularities, and stories that illustrate why fossil fuel combustion must end, and what endlessly rising greenhouse gas emissions are doing to our planet. More recently, in the last couple years, and especially while reflecting on this essay, my perspective has somewhat changed. A witness is “one that gives evidence.” To witness is “to testify to,” or “attest,” or “to furnish proof of, betoken.” In writing about global warming, and its growing consequences, what else have I been doing? My job as a climate writer has increasingly changed from translating scientific projections, explaining greenhouse gas emissions, and documenting the early signs, to witnessing the Trump administration’s active climate denialism as the impacts of a warming planet unfold. In the end, I am now, too, documenting atrocities, and their perpetrators.

Decades of climate projections – such as those made by the Yokohama Earth Simulator – have come true. A study published in January 2020 in the journal *Geophysical Research Letters* found that among seventeen temperature models developed between 1970 and 2007 to predict future warming, *fourteen* closely matched actual temperature observations through 2017.⁸ A 2017 report from the Royal Society warned that in many cases, scientists likely have been underestimating the risks of warming rather than overestimating them.⁹ Although the international scientific community, and the Paris Accord, established the safe upper limit of warming at 2 degrees Celsius, a landmark 2018 special report from the IPCC concluded that the impacts and costs of just 1.5 degrees Celsius (2.7 degrees Fahrenheit) of warming – from, for instance, sea level rise, record-breaking storms, increased frequency of heat waves, and wildfires – will be far greater than expected.¹⁰ The planet has already warmed about 1.2 degrees Celsius since pre-industrial times (the global land temperature has warmed an average of 1.8 degrees Celsius). There is no room for uncertainty about climate impacts now. Attribution science – or researchers’ ability to directly link the annual horror show of extreme weather events to human-caused climate change – is commonplace, and a rapidly growing field. And yet the U.S. president has rolled back every policy to reduce greenhouse gas emissions that he could, and fossil fuel companies – mainly oil and natural gas – continue apace.

There is an element of passivity attached to the word witness. The word can conjure up the idea of a neutral bystander, someone who happens to be present at the scene of a crime. I have been present at the scene of a global crime for my entire adulthood. But journalism and writing are never passive. Every sentence, every character, every quote is a choice. One seeks out the facts, the data and science, and investigates, in particular, those powerful actors who stand to benefit from the suppression of those facts: fossil fuel companies, the bankers and insurance companies that keep them going, and the politicians whose pockets they line. In a

way, my job is to actively be a witness to every side: those behind the fossil fuel industry and their methods, as well as the devastating consequences of this industry on communities, livelihoods, ecosystems: “to furnish proof of” their actions, to be there to witness the disasters, the extinctions, the destructions of ecosystems.

I recently interviewed a young woman and scientist, Corina Newsome, who is on the steering committee of a group called Young Evangelicals for Climate Action. She is finishing a master’s degree in avian ecology. She is studying seaside sparrows that nest on the Georgia shore, which are vulnerable to both predators and sea level rise. We spoke at length about how science, for her, is a form of worship, and she gave me another insight into the idea of witnessing. I had asked her what she thinks when evangelical Christians deny climate science and say that everything is in God’s hands. “To me, it’s a cop-out to protect their own privilege and to protect their own comfort,” she said. “People who I hear say that are the people who are not worrying about what they’re going to do when the next hurricane comes through. They are not the people who have food insecurity, they are not the people who are one catastrophe, one financial setback, from losing everything.” She went on, “To have the perspective that you are not going to do anything, and you don’t think anyone else should do anything, because God’s got it? That’s ungodly. You’re a bad witness.”

Witness, again, from Merriam-Webster: “a public affirmation by word or example of usually religious faith or conviction,” or, “to bear witness to one’s religious convictions.”¹¹ What she said reminded me that witnessing can and must be a constant, ongoing act. It is one reason why I still have hope after reporting on this topic for fifteen years, seeing so little change, and seeing the election of a climate denialist, while nearly everything that the scientists warned has come true. I even have hope despite the fact that, according to the IPCC report from late 2018, “coral reefs, for example, are projected to decline by a further 70 – 90% at 1.5°C,” with more than 99 percent loss at 2 degrees Celsius.¹² As grim as these projections are, the coral is not all dead *yet*. Much still can be done and must be done, and the work of a writer or journalist helps convey the urgency and the details. (Scientists, for instance, are replanting and breeding corals in damaged reefs; growing the most resilient species of coral in nurseries and transplanting them to the sea in ways that might increase their survivability; and developing corals resistant to climate change through accelerated natural-evolution processes.)¹³ Although I often get down, and I am not optimistic about the immediate situation, the state of our democracy, or the climate-caused loss, suffering, and grief that is already baked in, I also have hope because I see so many people, like Newsome, and other young activists, scientists, and organizers like her, who are out there fighting. Becoming a hopeless cynic is no different from being a “bad witness.” There is always more to write about, more voices to amplify, more wrongdoing and harm to document, more art to make. There is always more to do to make things better.

In 2018, I interviewed a scientist named Max Holmes, who studies Arctic permafrost and rivers, and who has testified before Congress about dangerous tipping points in our climate. He told me that for many scientists, if the evidence they gathered was not so devastating, it would be absolutely thrilling. Sending endless tons of greenhouse gases into the atmosphere, and thereby dramatically altering the climate is, in a sense, the biggest, greatest experiment the biosphere has ever seen. Scientists alive today are watching the data come back in real time. His comment struck a nerve, reminding me of Biosphere 2. This, of course, is not an experiment we should be running. There is no second planet. There is no escape to outer space. Biosphere 2 captivated my childish imagination because it was, in its initial conception, a fantastical exercise in turning away from the world as it is. It was a simulacrum of ecosystems: Disney World for the nature lover. Perhaps the joy of the fantasy came largely from the fact of reality, my overwhelming sense, at the time, that the planet I lived on was a stable place. That sense was destroyed in the course of my education, and in my first job as a reporter. I have set out to document the nightmarish experiment underway on the actual biosphere. At the same time, the wonder I feel when I consider life on Earth – in all its complexity, diversity, vulnerability, and tenacity – has only grown. That, too, gives me hope. I can now say that witnessing, in my work, is not just the act of describing what happened, or furnishing proof of the changing climate and its perpetrators, but a form of devotion – a never-ending act to affirm my belief in the grace of life.

ABOUT THE AUTHOR

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Slow Disaster in the Anthropocene: A Historian Witnesses Climate Change on the Korean Peninsula

Scott Gabriel Knowles

Despite their seeming reluctance to engage in the politics of the now, historians have a crucial role to play as witnesses to climate change and its attendant social injustices. Climate change is a product of industrialization, but its effects are known in different geographical and temporal scales through the compilation and analysis of historical narratives. This essay explores modes of thinking about disasters and temporality, the Anthropocene, and the social production of risk – set against a case study of the Korean DMZ as a site for historical witnessing. Historical methods are crucial if we are to investigate deeply the social processes that have produced climate change. A “slow disaster in the Anthropocene” approach might show the way forward.

We will make sure that every leader who hesitates and waffles on climate will be seen as another Donald Trump, and we will make sure that history will judge that name with the contempt it deserves.

—Bill McKibben, 2017

When it comes to sorting out the good and the bad, “history” is an activist. Placing a bad actor on the “wrong side of history” is a rhetorical strategy deployed by everyone from presidents to popes.¹ In moments of political turmoil, the impending judgment of “history” wields moral power. But what about the historians?

I trained as a historian of technology in the late 1990s. In those days, there was a fascination with the history of technological systems that built America: electrification, dams, highways, the Internet. I was more interested in why systems fail, and I wrote a dissertation about the conflagrations that destroyed American cities from Chicago to Baltimore to Boston in that heralded era of American ingenuity. I was on my way to Chicago to spend a week immersed in the archives of the Iroquois Theater Fire – the greatest fire tragedy of the twentieth century in the Unit-

ed States – and by the time my plane landed, the Twin Towers had been attacked in New York City.

In the months that followed, I listened to the braying of politicians decrying the attacks with an incessant focus on an external enemy, and I dove deeper and deeper into the equally unsettling history of the World Trade Center. The Towers were experimental buildings with known weaknesses to fire. There was no conspiracy here, just a long history of incomplete fire protection that was never fully realized until it was too late. The structural weaknesses had a history connected to the larger story of materials testing, building codes, the insurance industry, and urban politics. Unraveling that tangled knot became a central focus of my 2011 book *The Disaster Experts: Mastering Risk in Modern America*. What started as the history of a fire problem buried in the American past turned into a chronicle of continuity in risk and disaster. Disasters aren't events that float freely in history, unmoored from politics: they are processes, playing out in uneven temporalities, and always with deep histories.

A historian worrying about a missile attack while baking in a heat wave: that's me in the Gyeongui Line Forest Park in Seoul on a broiling summer day in 2017. I was for that summer a visiting researcher in the KAIST Graduate School of Science and Technology Policy, working with Dr. Chihyung Jeon to understand the causes and implications of the 2014 sinking of the Sewol Ferry. In many ways, it was a continuation of my previous work on the Twin Towers: searching for the obscured history of technological decision-making behind a major national disaster.

Construction on the Gyeongui Line, Korea's first major railway, began in 1902. In Seoul today, the rail line is submerged beneath the congested city, and the Forest Park is an urban oasis with water and trees and plenty of space for my two children to run and ride their scooters and make too much noise. Suddenly, my iPhone let out a terrible sound and the screen was full of text. I could hear other people's phones in the park making the same noise. Since I unfortunately don't read Korean, I quickly snapped a picture and texted it to my friend. What's happening? I asked, a bit urgently.

The summer of 2017 was an anxious one. My South Korean friends have grown up with post-Korean War polarization and the ever-present threat of violence, but I suspected that even to them this period of time was an unusual one. More certain of the diplomatic tactics of the North, they were highly unsure of the United States' recently elected and unpredictable reality-show president. On arrival in South Korea, I felt alarmed to read a recommendation that I should have gas masks for my family, and that we needed to know where to take shelter if a missile barrage were to start – and also that I shouldn't worry too much about such things.

But I'm a disaster researcher, worry is my business. Only recently, President Trump had warned North Korean President Kim Jong-un that if he continued testing missiles, the United States would rain "fire and fury like the world has never seen" down on Pyongyang. North Korea's response was a shrug, and then a threat to create an "enveloping fire" around Guam. Meanwhile, that week, the American press was busily churning out grim "scenario stories": What might happen if war returned to the Korean Peninsula? How many would die in the first hour, the first day, the first month? Some of these scenarios ended with full-blown nuclear war, while the rosier scenarios imagined only tens of thousands of civilians and soldiers being killed, primarily in Seoul and Pyongyang.

Back to the Gyeongju Line Forest Park: at last, a text message came back from my South Korean friend. It's a weather warning, he said, advising you to take care in the extreme heat. As I stood there squinting from the sun's glare, my shirt soaked with sweat, I appreciated the wisdom of this advisory. The reality is that the slow disaster of climate change on the Korean Peninsula is every bit as ominous as the threat of war, it's just unfolding at a pace that makes it harder for us to keep it in the front of our minds.

South Korean summer heat records have been broken over recent years: the old high-temperature mark for Seoul was shattered in 2018, in the midst of a heat wave affecting the entire Korean Peninsula, and directly causing at least forty-two deaths. This follows a similar heat wave in the summer of 2013. The trend is clear to climatologists. From 1971 to 2000, South Korea charted on average 8.5 heat wave days per year. By the end of this century, that number is expected to rise to 32.3 days per year – a full month of every year in a heat disaster. A recent public health analysis puts the rising heat in the context of life and death: between 2002 and 2013, 336,000 South Koreans were treated for direct heat-related illness, including heat exhaustion, respiratory difficulty, and heatstroke, with the reported cases increasing steadily year by year. Heat-related death rates are even higher in rural and poorer areas, where agricultural workers suffer and where elderly people often live alone and without good access to health care.²

Each of these effects local to Korea will likewise play out at the global scale, according to the most recent report (2018) of the Intergovernmental Panel on Climate Change. The twenty-first century will be one of a gradual and deadly warming – global yes, but uneven in its effects, and not equitable. This warming will be much harder on vulnerable populations: Black, Indigenous, People of Color, the poor, the young and old, the disabled and chronically ill. For nonhuman species, the impacts will likewise be dangerous, sometimes deadly, sometimes extinction-inducing. And, for the built infrastructure, shifts in heating and cooling patterns will affect roads and buildings, water (too much in some places, far too little in others) will challenge sanitation and water delivery systems, demand for air conditioning will stress the electric grid, and, increasingly, extreme weath-

er events will cause damage across all types of infrastructure systems from data to diabetes care with higher frequency and cost.

Of course, when I read my friend's reassuring translation of the warning text in 2017, I was relieved that war had not just been declared. This fear was replaced, though, with another one: a fear that tracks a threat just as grievous (worse even), but moving on a slower time scale. "Fire and fury" and "enveloping fire" are terrifying and poetic phrases, much more so than the rather flat "global warming," but global warming stalks me everywhere I go, not only in Seoul and Pyongyang. When I went home to New Jersey, far away from the emergency drills and gas masks, it was waiting for me there, too.

The *Anthropocene* is the time in which human activity is the dominant force of change on the planet. The terminology is in the strict sense geological, coined by atmospheric chemist Paul Crutzen in 2000. Geological ages are named for the organisms or processes that define the earth in their time. The Anthropocene is our time, an age marked by the increasingly obvious cumulative impacts of humanity on Earth systems, and more so by the cascading effects of human-crafted systems. If you are looking for the material evidence that scientific advocates of the Anthropocene collect and analyze, you should watch for concentrations out of place: too much phosphorus at the mouths of rivers and acid in the oceans, too much carbon in the atmosphere, radioactive particles and plastics everywhere. There are also absences: ice melt, vegetative loss, biodiversity loss, aridity.

The evidence for the Anthropocene as a stratigraphic layer of the earth with a clear starting point is still a matter of fierce debate among scientists, divided into roughly four camps: those who reject the concept out of hand; those who date the start of the Anthropocene to the advent of agriculture approximately ten thousand years ago; those who date it to the rise of industrialization roughly 250 years ago; and those who insist that the entry into the nuclear age marks the moment of the Anthropocene, beginning in 1945. Start date aside, there is broad consensus that a so-called great acceleration of Anthropocenic growth processes, from globalized industrial production, to GDP, to global population, to oceanic surface temperatures, is obvious from the 1950s onward.

The Anthropocene is by no means the first time humans have contemplated suffering, or even the complete end of humanity: apocalyptic eschatology is quite nearly a universal feature of world religions. It's not even the first time in which humans have contemplated their end brought by their own hand; that would be the Cold War "mutually assured destruction" era.³ But it is the first time that a mass extinction – including the *Anthropos* – is contemplated by us as a creeping process producing a slow disaster of global proportions, toxicity and global warming driving us from every corner of the globe to the same fate.

Climate scientist Will Steffen has also described the Anthropocene as a challenge of temporal imagination: “the concatenation of both slow- and quick-onset events ... can lead to some unexpected global crises.... The Earth System scale adds another twist to the concept of speed of change.... Humanity ... has no experience of dealing with such combinations of scale and speed of environmental change.”⁴ How long will it take? Is it too late? Is it reversible? Who will be the first to suffer, and how can their suffering be lessened? Are the same forces of industrialization that created the Anthropocene capable of being turned toward solutions? These are the existential questions of the Anthropocene, and they go well beyond geology.

Historians of disaster have a role to play in grounding these free-floating questions in local contexts: the Anthropocene is a global process playing out in human lives and communities every day. And in every one of those lives and places, there are historical trajectories, inheritances of place and politics that will shape who suffers more and who suffers less. Understanding the everyday politics of the Anthropocene requires the work of historians.

Climate change is a product of industrialization, but its effects are known in different geographical and temporal scales. This realization came home to me when I was researching the Twin Towers, but also Hurricane Katrina, Fukushima, and many other disasters of the past two decades. In each case, our naming conventions are to emphasize the *event* of the disaster over the *process* that made the disaster. The rush to name the disaster, investigate the cause, and get back to normal defines the work of the modern disaster preparedness state. I have struggled in my career with the temporal limitations of the term in its general (and I believe quite misleading) usage. What, I have wondered, if we named disasters by the processes that made them? The September 11 Terror Attacks, Fires, and Engineering Failures; the New Orleans Flood and Levee Failures of 2005; the Great East Japan Earthquake, Tsunami, and Failure of Nuclear Safety. This thought experiment takes us into useful conceptual terrain if we care to actually understand the social, economic, and political actors who establish so-called acceptable levels of risk, and why publics accept (or don't accept!) such levels. Following this path demands a history of disaster that is decidedly more complicated than a presidential “disaster declaration.”

War is the quintessential example of an anthropogenic disaster that we can apprehend as an “event in the now.” In terms of definitions, war fulfills the requirements of what we generally mean by disaster: it overcomes society's ability to cope with stress. That is what war is for after all: it is a human-induced disaster aimed at achieving political ends. As such, warfare cannot last beyond the time frame in which it is useful for the combatants. The time frame of war is short: it may be repetitive, but it is an imminent way of destroying, killing, and dying. War and other

so-called rapid-onset disasters fit the definition of “events” and, in fact, the classic social scientific definitions of disaster were framed in the early years of the Cold War, when governments (especially the United States) were funding research to model the societal impact of nuclear war. The model of disaster that emerged by 1960 in the writings coming from the Disaster Research Center was something that arrives rapidly, with little or no warning, and then it’s over. That aftermath phase is what the government planners were keen to predict: would society return to some sort of normalcy, or would society fall apart at the seams? Their conclusions weren’t optimistic, but are slightly beside the point here. What’s important is to note their framing of disaster as an event, the result of a shock from outside, overwhelming a particular community at a particular time.

The Anthropocene is also a disaster, but a slow one, moving according to a different temporal logic. The traditional definition of disaster describes an overwhelming event delimited by spatiotemporal limits that are tightly bounded with clear cause-and-effect relationships. “Slow disaster” is a way to think about disasters not as discrete events but as long-term processes linked across time. The slow disaster stretches both back in time and forward across generations to indeterminate points, punctuated by moments we have traditionally conceptualized as “disaster,” but in fact claim much more life, health, and wealth across time than is generally calculated. The slow disaster is the time scale at which technological systems decay and posttraumatic stress grinds its victims; this is the scale at which deferred maintenance of infrastructure takes its steady toll, often in ways hard to sense or monetize until a disaster occurs in “event time.” The experience of war victims fits the concept well, as does the process of climate change, sea level rise, the intensification of coastal flooding, and heat waves.⁵

Yet the old false binaries confront us at every turn. For example, in the aftermath of a disaster – like Hurricane Katrina, or the sinking of the Sewol Ferry, or the Fukushima Daiichi nuclear disaster – the event is often presented as a laboratory of sorts. After each of these crises, we hear a great deal from policy-makers and experts about the opportunity to “learn from disaster.” But we should be aware that this learning exercise is trapped in a dynamic that splits the technical from the social. In this mode, if the technical side of a disaster yields inconclusive results, then it is very hard for experts to reform technical practice. Strong pressures exist within technical expert communities to resist outside social and political influence. This is in many ways perceived as the very definition of science and engineering: to be able to deliver analysis and technology that are free from context, relieved of the corruptions of the social world. Of course, such avoidance in the Anthropocene is not only impossible, but the idea that disasters are not combinations of technical but also social and political forces is a dangerous one. Post-disaster investigations are often demanded by government officials seeking to have rapid and acceptable answers to technical questions, seeking to move quick-

ly past useful moments for debate over the larger forces at play in risk-taking. This rush to “learn” something, anything that can restart the reactors or re-open the flood plain for construction puts engineers especially into a very difficult position. What if what is learned from disaster is that there should be more technological restraint in a certain ecosystem, or that the unwanted effects of an industrial process aren’t yet knowable? What then? Is the lesson of disaster useless? No, but perhaps the answer will be unpopular, and not attuned to the “event” scale of disaster that so often demands our attention.

In whose interest has it been to define disaster as an event in the now, as an act of God, as an unwanted external, natural event? By way of answer, what you will have immediately observed from the discussion thus far is the lack of texture when it comes to ascribing human agency in the Anthropocene. And here is where history as a discipline can play its most constructive role as a witness. To say the era started with “industrialization” is intuitively correct, but it’s like saying a murder was committed by some criminals at some point in the past. We want to know more: Who were these criminals? Where was the crime committed, and what were the motives? In their 2015 book *The Shock of the Anthropocene*, historians Christophe Bonneuil and Jean-Baptiste Fressoz put the problem of causation and agency in the Anthropocene directly before us. “There is already an official narrative of the Anthropocene,” they note,

“we,” the human species unconsciously destroyed nature to the point of hijacking the Earth system into a new geological epoch. In the late twentieth century, a handful of Earth system scientists finally opened our eyes. . . . [But] this story of awakening is a fable. The opposition between a blind past and a clear-sighted present, besides being historically false, depoliticizes the long history of the Anthropocene. . . . In the twenty years that it has prevailed, there has been a great deal of congratulation, while the Earth has become ever more set on a path of ecological unbalance.⁶

The challenge then is two-fold: 1) to build historically rich accounts of the Anthropocene, a globally active process manifesting itself across a countless set of local domains; and 2) to attend to the ways that the Anthropocene discourse is shaping our understanding in the now. Who gets to say, who doesn’t, and why does that matter? Rising to this challenge has been a legion of scholars offering historically contextualized modifications to the notion of Anthropocene-as-process. These scholars are looking to take apart that duplicitous “we” and actually put some names with faces, so to speak. There are multiple different historically rich theories of the “social tectonics of the Anthropocene”: the nongeological forces that are altering the earth’s crust just as effectively as vulcanism or meteor strikes have done in previous geological times. For example, the *Capitalocene*: departing from the old line attributed to Fredric Jameson that we can envision the

end of the world more readily than we can the end of capitalism. The Capitalocene has some utility in addressing my previous question about the limits of learning from disaster. In this mode of thinking about the Anthropocene, it makes complete and total sense that learning will be bounded by the limits of ownership and profitability. There are other contenders, each championing a particular ecosocial history of planetary change: Plantationocene (slavery and monoculture), Carbonocene (carbon extraction/burning), Thanatocene (species extinction), and Chthulucene (interconnectedness of species), to name just a few.⁷

And so, the Anthropocene as a concept has slipped beyond the jurisdiction of the International Commission on Stratigraphy: the Anthropocene-as-social-process is now a mode of inquiry wherever people are interested in disasters and ways to prevent them. As an environmental studies heuristic device, it has some serious advantages. It is inherently interdisciplinary, it traffics in deep time and demands attention to scales from the planetary to the street corner, and it forces us to divest ourselves of the age-old “natural disaster.” In the Anthropocene, it is human activity itself interwoven into the natural that shapes reality.

There is only one place in the world where a person can see the Anthropocenic future in its full revelation, a place that simultaneously fully represents humanity while also being devoid of living humans. This place is the demilitarized zone separating North and South Korea. One hundred and fifty-five miles long and two-and-a-half miles wide, the DMZ is the world’s longest defended borderland, and by virtue of this fact, it is also the world’s largest space uninhabited by humans.

I rode the Gyeongui Line from Seoul Station to the DMZ. Most of the trip would feel predictable to anyone who has ever left a major metropolitan city by train: high rises give way to lesser high rises, smog gives way to clearer skies. But after about an hour, the so-called Peace Train, beautifully decorated with bright flowers and showing cheerful videos, slows considerably, and then you become aware of changes in the land: an intensification of the greens and blues, and a heightened awareness on board as the fences and the soldiers come into view.

I disembarked at Dorasan Station, a beautiful but empty modern station just south of the border. It took me some time before I understood that this was, and is meant to someday again be, a border crossing. A soaring waiting room is edged by a tourism information desk, presumably there to provide aid for South Koreans headed north, and for their North Korean counterparts heading south. One can even see the border crossing station itself, where passports will be checked and bags inspected. And there on the departures board, Pyongyang is listed.

From here we were ushered into a cheerful theater where a short film told us three basic stories: first, the historic story of the war and the partitioning of the Korean Peninsula; and second, the continuing depravity of the North Korean



Soldiers on the Gyeongui Line “Peace Train” to Dorasan Station, South Korea, 2017. Photo by Scott Gabriel Knowles.

military (with its prolific tunneling under the DMZ and into South Korea) and the imminent threat the military posed to democracy in the South. I was prepared to receive these messages in a new way: North Korea was eager for reunification the film told me, and it wouldn't be through nonviolent means. The tunnel was the evidence, the film instructed me; remember the tunnels.

The third story caught me quite unprepared. Because of the incomparable situation of the DMZ, its four hundred square miles of unhumanity, it is in fact the world's largest wildlife and botanical refuge! The buoyant tone of the film carried us to the conclusion that when (not if) Korea is reunited, the nation will be left with this amazing park – a so-called Peace and Life Zone – a reminder of its past transformed into a beautiful symbol of peace. I couldn't help but wonder about the alternative endings for the film, the ending where reunification doesn't easily occur and the DMZ serves as a militarized wildlife refuge for centuries, not decades. Or, an ending darker still, the social tectonics of the Anthropocene eventually render the DMZ useless because of societal collapse. I began to see the DMZ as both a historical record of conflict and also as an experiment station for life-after-humans.

As I contemplated this last idea, the guides herded us back onto the bus for the pinnacle of the tour: a visit to the mountainside lookout where visitors peer across the DMZ and into the North Korean border town of Kijong-Dong. I looked across that emptiness, desperate to see a person – a real North Korean – but I only saw the streets, smokestacks, and houses of Kijong-Dong. I found out later that I was looking for people in vain, Kijong-Dong is only a model town, apparently no one lives there – the lights go off and on in the buildings controlled remotely with timers, and soldiers disguised as civilians sweep the streets.

I was standing on the edge of the most heavily monitored, seen, listened to, tunneled, and militarized spot on the planet, and I felt profoundly lonely. It was a place unlike any other, and yet totally representative of what the Anthropocene portends: high-tech, war-torn, and empty of human beings.

Now if you forget humans for a moment, there is definitely life in the DMZ.⁸ There are over five thousand species of plants and animals here, including 106 that are endangered and protected. The geography of the DMZ from one side of the peninsula to the other crosses many different types of ecosystems. It was first proposed as a park in 1966, though this idea has still not been accepted by the North. Thousands of migrating birds from across Asia stop here every year. These include the famous red crowned and white-naped crane. Siberian tigers are rumored to be here, too.

These are, for now, the residents of the proposed Peace and Life Zone of the DMZ. But what if we excavated the Anthropocene layer at the DMZ – a discovery mission for the Korean Anthropocene? What would we find? Could we put together a coherent account of human life, and human death, on Earth? Start with

the North Korean border towns of Haeju and Kaesong, each has a deep human history, with remnants of early farming cultures dating back to the Neolithic period over ten thousand years ago. Pottery and stone tools have been found with a long history of small-scale empire-building through agriculture and through warfare. We could have a look inside Gung Ye's castle, ruins of a tenth-century civilization that sits abandoned today in the DMZ. Closer to the surface, we would discover the industrial layer, zinc mines close to the border, and, of course, railroad tracks. That very railway where my voyage started, the Gyeongui Line, passes through the DMZ. In its excavation we might come to know a much more complicated history of the ways that imperialism and industrialization have shaped the DMZ. The Gyeongui Line, though planned by the Korean government of the late nineteenth century, was replanned and built by the imperial Japanese government that occupied Korea from 1910 to 1945. This railway line was seen by the Japanese colonizers as the tool of modernization in the peninsula, unifying the economic regions of Manchuria and allowing for rapid deployment of Japanese troops. Industrialization and violence, together as always. The DMZ will hold traces of this imperial past, underneath a thicker layer of debris marking the Korean War from 1950 to 1953. Specially authorized excavations here, for example, in the 1990s and 2000s uncovered sixty-four South Korean war casualties from those years. One layer closer to the surface we will find undoubtedly the markers of atmospheric nuclear testing (that's a global marker). The most dangerous reminder of industry is here at this level as well: there are an estimated two million land mines in the DMZ.

Now let's come up to the surface layer of our time: Since 2002, the jointly managed Kaesong Industrial Region has offered the promise of collaboration by the North and South, a sort of protoreunification experiment (closed for a while, due to re-open); it is telling that industrial production was seen as the most promising way to accomplish this *détente*. To both North and South, since 1953, moving toward vastly different political goals, intensified industrialization has been the strategy. The Anthropocene, we might say, is ideologically pluralistic. To paraphrase sociologist Ulrich Beck: industrialization can be authoritarian or it can be democratic; pollution is pollution and it doesn't respect boundaries.⁹

We don't know how this Anthropocenic excavation will end: another war debris and nuclear layer, or a thicker layer marking the slow disaster of warming, aridity, and pollution?

Or is there another option? I don't think any of us would be willing to work on slow disaster and Anthropocene research if we didn't actually, maybe quietly, hold onto the idea that a course correction is possible, that a path away from the apocalypse is at hand, that we don't have to die in the Anthropocene after all, that the field notes of the Anthropocenic DMZ excavation may indeed someday be collected by a person visiting a wildlife refuge.

Disasters concentrate violence in moments. The emergency management bureaucracy draws lines around events that seem containable: dead bodies, acreage burned, insurance claims adjusted. The rush to make sense is met by the push to rebuild. But disasters are also slow. The failure of a levee, like the first shot in a war, is the accumulation of political and material events that stretch back in time, often to indeterminate points. The desire to bound a disaster in time and place is itself a form of politics, a politics of disaster amnesia, cutting effects off from causes, and from futures. Disaster history is one tool useful in filling in the erased moments in the record, slowing down the disaster and analyzing its complete temporality, drawing more players into the drama, tallying more deaths and financial losses than a “disaster event” tabulation would ever allow. A slow-disaster methodology is crucial if we wish to ascribe blame (and sometimes credit) and seek justice for the impacts of disasters in society.

Climate change, in particular, presents a disaster at the global scale where historical analysis proves necessary. The formation of public policy that can meet the challenges of climate reality in the twenty-first century relies on an ability to explain environmental change over long stretches of time, and to connect change to human actions. The historical profession has already been altered by this challenge. Climate change has dragged historians across many subfields of research directly into the public square.¹⁰ Indeed, entirely new realms of inquiry like Anthropocene studies and disaster history have emerged precisely in reaction to the new public demands for knowledge in the climate debate. Inside the academy, but also in the realms of public history, museums, memorials, and artistic practice, a new consensus is emerging over the responsibility of historians to direct their energies toward engagement in ways not seen since the civil rights and antiwar battles of the 1960s–1970s.

The American Historical Association (AHA) with its twelve thousand members serves as the largest corporate body of historians anywhere in the world, and includes U.S. and non-U.S. citizens among its ranks. The AHA’s “Statement on Standards of Professional Conduct” inscribes the tension between a responsibility to professional practice and the imperative to bear public witness to contemporary conflicts. “While it is perfectly acceptable for historians to share their own perspectives with the public,” the AHA cautions, “they should also strive to demonstrate how the historical profession links evidence with arguments to build fair-minded, nuanced, and responsible interpretations of the past.”¹¹

This historians’ code of professionalism deems it “acceptable” to witness current events, but only with great caution, and always with the tether back to professional practice. There is no claim to a deeper moral understanding or to a stronger sense of responsibility to democracy, or to humanity, than that of the average person on the street. The implication is that a dispassionate analysis of the past may

yield useful insights into the present, and that's about as far toward activism as any historian should go.

Professionalism notwithstanding, the silence of experts in the face of wrongdoing is not a neutral act, it is itself a mode of speech, a tacit acceptance of the events of the day, and professional historians know this as well as anyone. Historians, and not just as private citizens, have at crucial times channeled their professional authority in the face of moral challenges: the anti-Vietnam War and civil rights movements counted historians in their ranks. Fifty years ago, a meeting of the AHA boiled over into direct confrontation between defenders of the professional status quo versus upstarts who wanted the profession to take a strong stand on the war in Vietnam and civil rights.¹²

This moment of radicalism in the profession was not a knee-jerk reaction to headlines, but instead reflected a previously obscured dialogue between the past and the present moment. The historiography of the American Civil War before the 1960s undergirded an anti-civil rights politics for many, many decades; it was not neutral. Indeed, in its presumed fidelity to the historical record – a record impoverished of the African American experience – the historical profession stood as silent as a statue of a Confederate general. But engagement of the profession and its leading practitioners in the history of race and racism at that moment in time set a pathway forward to future scholarship. This is precisely how historian E. H. Carr described the process through which new “facts of history” are discovered: by the re-opening of a historical record that was somehow previously silent on an issue. The archive, in other words, is always in formation, and this formation of the past is in direct dialogue with the present, and with the historian as a witness to the urgency of her times. Indeed, when historians start looking, they find a record that screams, and in that volume and dissonance they “make” history. So there is a causal relationship between the present, moral outrage, the historical record, and the historical craft.

The AHA itself, protector of the detached historical judgment, has waded into a number of controversies (not just American ones) over the past three years, issuing statements on the 2020 Census, Deferred Action for Childhood Arrivals (DACA), white nationalism and domestic terrorism, U.S. Immigration and Customs Enforcement (ICE) raids, and even on actions of the Hungarian government. AHA Executive Director James Grossman addressed this more activist stance in 2019. “The current moment presents an unusual landscape of responsibility,” Grossman explained. “I have not been among those who see fascism creeping into our political processes, but I do see something happening that differs from anything I’ve seen before. If a clear and present danger does exist . . . the AHA has a responsibility to participate beyond its normal conventions.”¹³

The regular Conference of the Parties (COP) meetings and Paris Accord discussions, as well as every climate change summit going back into the 1990s, frame

climate change as a forward-looking problem. It is an existential crisis at the global scale. In the midst of these discussions, the past is almost silenced, but not entirely. Those carbon emissions came from real places on the planet, and the environmental assault of climate change can be dated. It is not, of course, one event, one place, one actor – again a problem because such findings would aid in the legal recovery process, such as those brought about by island states looking now at the very prospects of moving their entire populations. As of now, the AHA has issued no statements – and the historical profession has been mostly silent – on the existential threat of global climate change. But if we consider the recent outpouring of works on disaster history and the Anthropocene, we can see the historical profession tuning up for intervention in the politics of climate.

Historians don't offer forensic certainties. But through excavating the layers of history as I have presented in this essay – taking core samples of the land on which we stand today – historians can and must bear witness to the social processes that have produced climate change. A “slow disaster in the Anthropocene” approach might show the way forward.

AUTHOR'S NOTE

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Let Me Tell You a Story

Antonio Oposa Jr.

I've spent my time caring for the Life-sources of Land, Air, and Waters – the LAW of Life. It began by being touched by the Sea and the story of my mariner grandfather. It went on to raids to fight environmental crime syndicates in the Philippines and on to the court of law. The Court is a good venue to light a STAR: to tell a Story, put the issues on the Table for orderly discussion, spark Action, and arrive at a Resolution. I founded the SEA Camp (Sea and Earth Advocates) to train children to care for the Sea and Earth and, later, founded the School of the SEA. Twice – in 2008 and in 2013 – I saw the School erased by an extraordinary typhoon, a foretaste of the climate crisis. I've realized that when you use the law and science to change the mind, it can change tomorrow. But when you change the heart, it is forever. In the midst of the ongoing climate and COVID-19 crises, I believe that we can change the story of the world if we change the storyline. "The seeds of goodness live in the soil of appreciation for goodness."

Do you know this good-looking gentleman? Is he a military man? An actor? You probably don't. He was my grandfather. He was a merchant mariner, one of the first in my country, the Philippines. He was a rich man and I grew up with him. He treated me like a son.

At eighty, he passed on. A day after he was buried, his lawyer called me and requested that I visit his office. There he told me that my grandfather left me an inheritance of about \$10 million.

What does a sophomore law student do with that kind of money? I deposited it in the bank. The day after, I withdrew \$2 million. I took my friends out drinking, carousing, and gambling. In a few hours, \$2 million was gone. The next day, and for three more days after that, I did the same thing: withdrew \$2 million, went drinking, partying, and gambling. On the sixth day, I had only about \$100,000 left.



What took my grandfather eighty years to save, I squandered in less than a week. As if that is not bad enough, I went to my accountant and instructed him to list all my expenses and losses as revenue and profit. I also told him I was making good progress in my quest for mature development.

Is that correct?

Are we not doing the same thing to the Earth? The Earth took 4.5 billion years to become what it is. It is the only planet known to contain Life and the sources of Life: the Land, Air, and Waters (LAW) of Life.¹ The animal *Homo sapiens*, in its present shape and form, has been here only for the last one hundred thousand years or so, literally a blink of the eyes of Grandfather Time.

About two hundred years ago, the industrial revolution began the era of mindless consumption: We started to use Earth's Life-sources faster than they could replenish. We cut down trees that took all of time to grow, sell them off as lumber, and count them as revenue. We scoop out the Seas to eat fish by the millions of tons, fish that were here long before us. In a matter of hours, we dig out carbon that formed over one hundred million years, and burn it as coal, oil, and gas. In a matter of minutes, we burn them to run our cars and light our homes, belching out poisonous gases into the very Air that we breathe. We take out so much from the Earth, use it for a while, and then throw it away as "waste." We call it progress and development.

And we dare to call ourselves "wise." *Homo sapiens*.

Oh, the story of my grandfather? It is only a story. The best stories are those that blend fact, fiction, and fantasy. The fact is that he was my grandfather. He was a merchant mariner and I grew up with him. The fiction is that he was very rich. The fantasy is that he left me a big inheritance that I squandered in a few days.

But, again, is this not the fantasy world we are living in? What took the Earth 4.5 billion years to form, we burn in a blink of an eye. And what remains we throw away as solid, liquid, and gaseous wastes. And then we call it a "contribution to GDP," that modern measure of "economic progress."

The textbook definition of the word *economic* is the "efficient use of scarce resources." Is waste good economics? What is the meaning of GDP? Gross domestic product? Or great disaster for the planet?

U*nguided missile*. Shortly before I was born, my mother was diagnosed with throat cancer. I was hurriedly left in the care of my grandparents. My grandfather was a harbor pilot and merchant mariner, and my grandmother, a loving homemaker.

My adolescent years were unremarkable. My only achievement, if one can call it that, is that I was kicked out of two high schools. The last high school that accepted me put me on probation for two years. And during that time, the school gave me the lowest conduct grade ever given to any student in its entire history. It

was not for any serious offenses (such as for fighting, drinking, or stealing). It was only for being generally restless, for mischief making, and for rabble rousing. This was before medical science discovered the meaning of attention-deficit/hyperactivity disorder (ADHD).

Luckily, I graduated high school on time. Not knowing what better to do, I took a course on business administration. After graduating, I worked for an investment bank as a “financial analyst.” In other words, I spent day after day counting other people’s money, and trying to figure out how to make them more money.

In the world of business, I saw how others advanced their careers with an MBA (master of business administration). So I took the qualifying exams to two U.S. business schools: Wharton and Harvard. I took the exams twice. I flunked twice. Thank you.

After one year as a junior financial analyst, I was promoted. On the same day I was promoted, I resigned and decided to be a . . .

B*each bum.* My grandfather, who was my adoptive father, was from a small and remote island in the Central Philippines: Bantayan Island in the Province of Cebu. In his later years, he bought a coconut farm there that had a little opening to the beach: turquoise water, blue clouds, and palm trees shooting up from the white sand.



The seashore that began a Life’s SEA-change, Bantayan Island.

Holy Week in the Philippines is a four-day holiday affair: from Holy Thursday to Easter Sunday. During these holidays, my grandfather would take me to Bantayan Island. Even today it takes a full day of multimodal travel. Perhaps because it is far, the island is preserved a bit better than others.

On Good Friday in 1975, we went to Bantayan for our customary beach picnic. I was twenty years old and had just graduated from a prestigious business school in Manila. When there were not too many who could afford a car, I had a sports car. In my hometown in Cebu City, I was the prince of a ten-bedroom prewar house. I had servants, a car, and a chauffeur at my beck and call. When not many people could afford a plane ticket, I shuttled to Cebu and Manila every few weekends to visit my grandparents – and my girlfriends in both cities. A typical rich kid, an unguided missile.

Walking along the beach on this remote island that Good Friday, I saw the homes of the fishermen. They looked “poor.” A thought passed my mind: If a poor man becomes rich tomorrow, that is easy. But what if a rich man became poor tomorrow? I wonder.

In a moment of mere madness, I decided to try being poor. I decided to stay behind on the very remote beach that had no electricity, no running water, not even a market. Except for a shack that served as our beach picnic area, there was nothing there. I stayed behind with one pair of pants, two shorts, a couple of T-shirts, a pair of flip-flops, and about 100 pesos (2 USD).

*That was the beginning
Of this long walk to simple living.
A small step in a journey,
By the Sea.*

Law school and an awakening. With a business management degree, a stint in the world of money, and after beach bumming for a year, I realized that I knew absolutely nothing. I hardly even knew how to read. I thought that maybe I should go back to school. Being a doctor (like my father), an engineer, or an architect was out of the question.

I learned how to seek the advice of the Sea. After dinner, I would go out to the beach, listen to the silence of the heart, and to the whisper of the waves. I was told by the Sea that I needed to learn how to read. And what could be better than the serious reading required by law school? So I applied to the country’s top law school at the University of the Philippines (UP). Not too many were interested in law then for the simple reason that it was the era of President Ferdinand Marcos’s one-man-rule under martial law. Very few applied, so I got lucky and made the cut. And thus began my journey of learning how to read.

I coasted along law school for two-and-a-half years. (A law degree in the Philippines takes four years.) For the first time, I was forced to sit down, read, and try to understand what I was reading. It was an insignificant time in my Life. Law school, and the way law is taught, is very boring.

Then, in the second half of my third year, I went home to Cebu for the Christmas holidays. I invited my best friend from the Island (Johnny) to join me. At about three o'clock in the morning of December 29, 1979, there was an accident. A big prewar house where I grew up, and which seemed indestructible, burned down in less than an hour. The fire took the Life of Johnny. Barely able to escape it myself, I went through suffering that you would not wish even on your worst enemy.

I went into a coma for forty days. By the sheer magic of modern medicine and the dedication of the men and women who cared for me, I woke up. The Spanish have a nice saying: *mala yerba nunca muere* ("bad grass never dies"). From my journey of learning to read began my journey in search of meaning.

Maybe it is true that what does not kill us will make us stronger. I began to appreciate the value of Life, and a search for something beyond my own. In law school, I asked now: what is the *law*?

Back to living life. After a year's leave of absence, with a brain addled by anesthetics, sedatives, and painkillers, I went back to law school. Reading and remembering were not very difficult. They were impossible.

But somehow, despite being boring, law began to have some meaning. It is something that took me a lifetime to figure out.

In my last year of law school, my undiagnosed ADHD acted up again. I had to find things to do outside of the law's hallowed halls. Between, and sometimes cutting, law classes, I went to take other classes in the other colleges. The teachers were kind enough to let me sit in on classes of literature and philosophy. Before my accident, I played the guitar quite well. With lost dexterity, I tried to find another musical instrument. So I thought, what is the best musical instrument? The Human voice? If so, can I try to train it in the UP Conservatory of Music? And in my last year, I organized the Forensic Society (public speaking) and made it to the editorial board of the *Philippine Law Journal*. My grades were not too bad. Grades are like money. If you do not chase them, they will find you.

But my best work in law school was in peacemaking. I invited representatives of the student government, law school groups, and (often-warring) fraternities to plant trees in front of the UP Law Center.

Today, decades later, those trees are standing there, alongside others planted by those who were inspired by our efforts. Today, in their own little way, they give shade and help clean the Air.

Managing to pass the bar exams, I became a lawyer. Now what? I was offered jobs in prestigious Manila-based law firms. I thanked them for the honor, but respectfully declined. Instead, knowing nothing, I went back home to Cebu and began a law practice. I wanted this license in law to do something meaningful.

I gave my legal services, *pro bono*, to detainees who did not have a lawyer. I volunteered for the Legal Aid Committee of the Bar Association, and as the Court's *de officio* counsel for the criminal cases: prosecution or defense, whoever cannot afford a lawyer.

That was good litigation training. My practical approach was to approximate human and divine justice. If a client was guilty, I did not try to acquit him. That would be an injustice to the offended party. Rather, I would only try to get my client the best plea bargain that the law can give. Whether I was for the prosecution or for the defense, I tried to be fair and square. With that as my guiding star, I achieved the purpose of approximating the idea of justice: to give and receive what is deserved. In two years of rough-and-tumble litigation, I did not lose a single case.

How did I survive financially? That was another little piece of magic. Having learned to live simply, I did not need much. I even took care of my grand (adoptive) mother. I built a small native-looking house made of wood, thatched roof, and bamboo on a small piece of land up a hill. It had a wonderful view of Cebu City, the Sea, all the way to the neighboring islands, and had enough space to take care of my long-time dream pet: a horse.

After these few years of hard-knuckles law practice, I was again bored and decided to change paths. I applied to a top Manila-based law office and practiced commercial law for three years. Of course, I eventually found it boring, spirit-sapping, and devoid of meaning.

W*hisper of the waves.* On the beach of Bantayan Island, I asked the Sea again. What now?

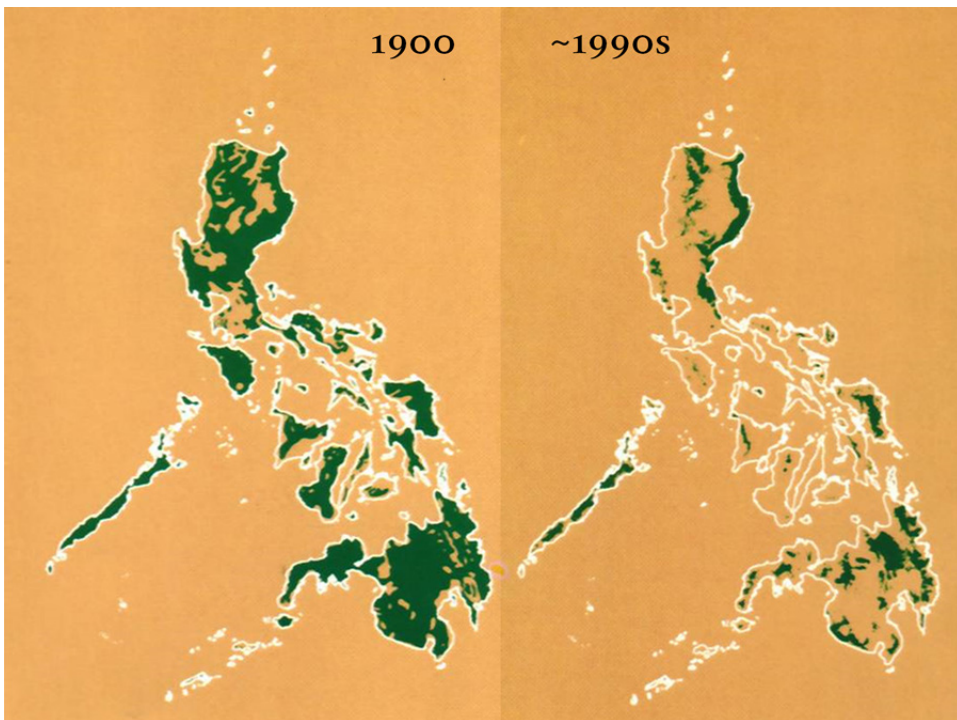
On one hand, here I am, a lawyer. On the other, the only things I really cared about were the Sea, the trees, and the fish.

The waves did not whisper an answer. I only heard their sound and saw the sparkling stars of the evening skies. With the guidance of two of my former law professors, I discovered that there was such an animal called environmental law. What is that? What is this creature called the "environment"? In 1988, I traveled to the University of Oslo to take a short course on energy and environment. After that, I published my first article on climate change and soft energy paths, in a leading national newspaper.² Of course, nobody read it, not even me.

Taking another leap of folly, I began to focus my practice on the then-unknown field of environmental law, mainly *pro bono*. I thought that maybe I could use the law to protect the Sea, the trees, and the fish, even if they cannot pay my attorney's fees.

To pursue this creature, I uprooted my family from Cebu and moved to mad Manila. It was during this time that I discovered the serious condition of the country's old-growth forests. From about fifteen million hectares forty years before, only eight hundred thousand hectares remained. More amazing was that despite this fact, during Marcos's martial law era, from 1972 to 1986, the government granted logging concessions to an area covering about four million hectares. Do the math: the government granted five times more old-growth forestland for logging than was available. And these forests were being cut down at the rate of one hundred and twenty thousand hectares per year.

One does not need rocket science to figure out that the numbers don't add up. To my simple mind, it was simply this: when my children grow up – the eldest of whom was then three years old – they would never see a Philippine forest.



By 1988, only eight hundred thousand hectares of the Philippines' old-growth forests remained (green areas on the maps). The government had given rights to commercial loggers to finish the job. Image courtesy of Peter Walpole and the Environmental Science for Social Change, Ateneo de Manila University.

If I went to the media and attended hearings in Congress, who would listen to a young lawyer who represented trees? Even if they did listen, I might get ten seconds of their attention.

But in a court of law, the story can be told better and the issues discussed more extensively. The points to ponder are placed on the table for proper discussion and backed by evidence. And then, who knows? Maybe it will spark some action. In the end, one way or the other, win or lose, sooner or later, there will be a resolution.

With my children and the children of my friends and relatives acting as plaintiffs, representing their generation and generations yet unborn, I set out to tell a simple story in a court of law. We petitioned the Department of Environment and Natural Resources (DENR) to stop issuing timber licenses. The Philippine Constitution lays out the duty of the state to “protect and advance the right to a balanced and healthful ecology in accord with the rhythm and harmony of nature.” We argued that this responsibility includes, among many roles, managing and preserving the country’s forests. Dismissed in regional court, we brought the story to the Supreme Court.

The case found a willing and understanding defendant in the Secretary of the Environment and Natural Resources Fulgencio “Jun” Factoran Jr. To his eternal credit, Factoran used the case to do the right thing. In 1991, while the case was pending, he issued a brilliant departmental order that stopped all logging in the remaining eight hundred thousand hectares of old-growth forests. One year later, in 1992, President Corazon Aquino signed into law the National Integrated Protected Areas System (NIPAS) Act. It named the remaining old-growth forests as the initial component of the country’s protected areas. Yes, the stars aligned.³

So, the policy matter – the ban on the remaining old-growth forests – was happily resolved by the executive. But a point of principle was not resolved by the trial court. The case was dismissed in regional trial court because the children, representing themselves and future generations, did not have a cause of action. That was a major setback in my effort to tell a story, and it posed a major dilemma. Here I was, a young and jobless lawyer. What can I do? What must I do? The better option is to let it go and move on to earn a living for my young family.

But being a hard-headed SOB (son of the beach), I decided to bring the matter to the highest court. Win or lose, who cares? I had nothing more to lose anyway, since I already lost in the trial court. All I had to spend was time, effort, and some money for photocopying, filing fees, mailing, transportation, and so on: quite a lot of money that I did not have. All I really wanted was to tell a story, to make a point of principle, a basic truth: that with what we were doing to the forests, the children and future generations have a right to speak, to take action, and to be heard in a court of law. Hard-headed SOB asking for the ridiculous.

The stars again aligned. After the case was lost in trial court and when I decided to take it to the Supreme Court, I discovered another wonderful creature that gave a sophisticated name to what I was trying to do. Through Dinah Bear, then general counsel of the U.S. President’s Council for Environmental Quality and Chair of the American Bar Association Committee on Environmental Law, I discovered the

work of someone by the name of Edith Brown Weiss of Georgetown Law. A couple of years before I filed the case in 1990, she had already written an entire book entitled *In Fairness to Future Generations*. In that book, she coined the terms *inter-generational justice* and *intergenerational responsibility*. Wow. Big words. But it was the theory that legitimized my simple idea of our duty to our children and to future generations. Now I could present this book to the Supreme Court. Maybe they will see that this idea is not so ridiculous after all, and that I am not as dumb as I look.

The stars aligned once more in the Supreme Court. The case landed on the desk of newly appointed Justice Hilario Davide Jr., a true son of the Soil. In his hands, the legal action was transformed into a wonderful narration: a story that trembles on the brink of poetry. On the question of whether the children and future generations had the right to take this legal action, the Supreme Court said,

These rights need not even be written in the Constitution for they are assumed to exist from the inception of humankind. If they are now specially mentioned, it is because . . . unless it is written in the Constitution itself, the day would not be too far when all else would be lost, not only for this generation but also for succeeding generations, generations which stand to inherit nothing but a parched earth incapable of sustaining life.⁴

The passion for the trees and forests led me to bare-knuckle fights to stop commercial illegal logging. I began to explore the uncharted techniques and tactics of effective environmental law enforcement. The lesson I learned was that “The best form of law enforcement happens when the law does not need to be enforced. . . . If the law must be enforced, and a penalty is handed down, it must be done in a manner that is swift, painful, and public.”⁵

It also led me to begin exploring the idea of legal marketing: the art and science of selling the social good behind the law, the reason for the law, the *ratio legis*. Ordinary marketing sells a product. Law sells a mode of conduct.

In 1992, a wonderful man was appointed secretary of the DENR, Angel Alcala, a marine biologist and man of the Sea. We worked together to address the illegal commercial logging in the country, an industry with powerful backers, many of whom were in positions of great power. With a new law and a new president in 1992, there was hope in the Air. I declined Secretary Alcala’s offer to join government service as undersecretary for legal affairs. But working with the same love for nature, he took my humble advice to heart. Together we did amazing things to break the neck of illegal commercial logging. For the first time ever, there was waged a Land, Air, and Sea enforcement operation against illegal logging: the *Oplan* (Operations Plan) *Jericho*.

We created a special strike force to hit at the nerve centers of the illegal logging industry. We mobilized dedicated men from the Special Forces of the Army, Air Force, Navy, the National Bureau of Investigation (NBI), and the Department of

Justice. But just when it was beginning to break the neck of the illegal commercial logging, Secretary Alcala was replaced.

With this, I learned a lasting lesson: government is a most fickle and unreliable partner. Sure, with the right people at the helm, it can do so much good during their time in office. But when the next person takes over, they will try to reinvent the wheel altogether. That is mainly the challenge for good governance: the lack of continuity.

Frustrated, I went on an extended holiday in Boston.

A year later, I returned to the Philippines with a fancy degree from a fancy law school. But instead of building on these credentials and making big bucks in the practice of law, on September 8, 1998, I made another mad, but maybe momentous, decision. I wrote a letter to all my paying clients to thank them for their confidence and to advise them that I was moving on. In one fell swoop, I gave up my revenue-generating law practice. I moved my office from the heart of the business district to a small and nondescript office not too far from my home, thus saving time from the long commute. I decided to focus my time on writing two books: *A Legal Arsenal for the Philippine Environment* and a storybook entitled *The Laws of Nature and Other Stories*.⁶

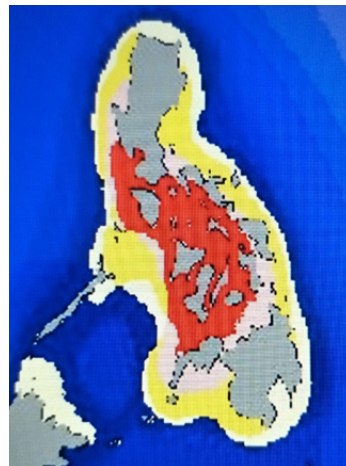
Four months later, jobless, penniless, and almost hopeless, I filed another crazy case. This time it was against a dozen government agencies to compel them to clean Manila Bay.

Center of the center of marine biodiversity. The Waters surrounding the central Philippine islands from Manila Bay in the north to northern Mindanao in the south (red on the map) are known as the “center of the center of marine biodiversity on Earth.” This was an early finding of the world-renowned marine biologist Kent Carpenter.

The Manila Bay is a body of Water that lies in the apex of this area. In 1998, I stumbled on government records that Metro Manila alone was dumping sixteen million liters of raw sewage into Manila Bay, every single day. Maybe, it was time to tell another story.

This storytelling exercise was quite expensive, in time, effort, and money. It took all of ten years of litigation from trial court, to the Court of Appeals, all the way to the Supreme Court. Ten years, and all I got was a piece of paper that said the government must do what it should have done thirty years ago.

Has Manila Bay become cleaner since? In 2018, the scientific data showed that it got worse – one hundred times over. To the credit of the people in present po-



sitions of power (President Rodrigo Duterte, Secretary of Environment and Natural Resources Roy Cimatu, and Secretary of the Interior and Local Government Eduardo Año), there is now a serious effort to clean Manila Bay. Bravo! May your tribe increase, and may your efforts continue.

I fought many other cases in the courts of law. Often, I lost, sometimes I won – a paper victory. But through it all, I learned three important lessons:

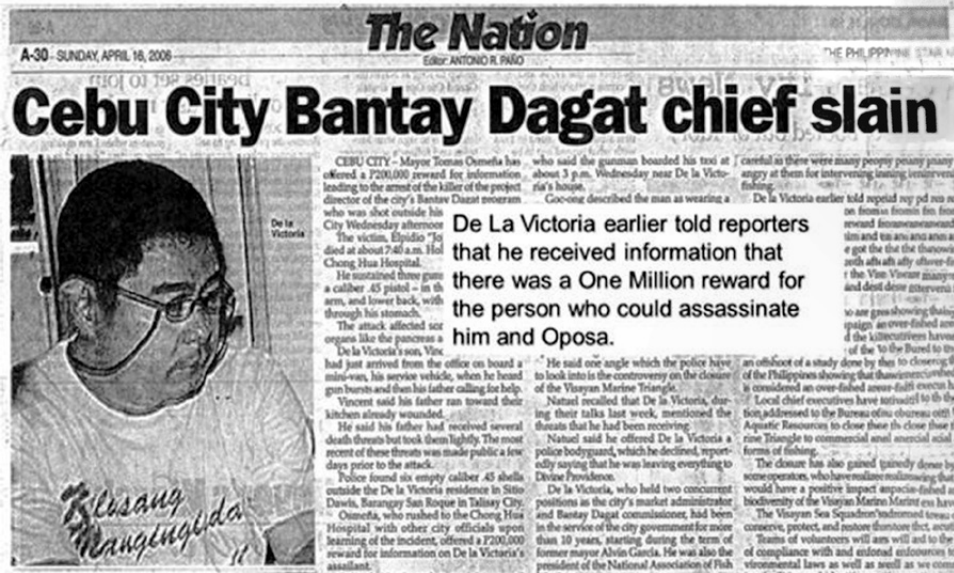
1. It is all about telling a story. And I am only a storyteller, with words as my paint brushes, law as the medium, and the courtroom as the canvass on which to paint the story.
2. Win or lose, sooner or later, the end goal does not matter much. The only thing that matters is the joy of the journey.
3. In triumph and in disaster, only one thing will matter: laughter.

Wounds of war and bruises of battle. I fought other battles in court, on Land, and at Sea. I engaged in *mano a mano* combat to stop illegal logging in Oplan Jericho. In one case, I lost our star witness, Leonardo Tindoc. A dedicated government forester, he was murdered in front of his home.

At about the time I sued to clean Manila Bay, I began another adventure to care for the Sea. From cases in court to direct action seaborne operations, I tried to do it all. I organized another multisectoral, citizen-led legal strike force against environmental crime syndicates behind the illegal fishing business. Small blast fishermen in the open Sea detonate explosives in the Water to kill large amounts of fish indiscriminately, often destroying surrounding ecosystems like coral reefs. Instead of running after the small fry, we went for the “big fish.” With our team of dedicated citizens and NBI special agents, we went after the syndicates making and selling blasting caps and explosive powder. I’ve shared a short film clip of the strike force’s operations.⁷ It shows two of our many bold raids to arrest members of the blast fishing syndicates and to jail rich owners of commercial fishing boats that illegally intrude into municipal Waters reserved for small subsistence fishermen.

I stepped on many powerful toes and earned death threats in the process. On April 10, 2006, a news article in a local paper reported that there was a bounty of 1 million pesos for anyone who could kill me and my buddy and fellow guardian of the Sea, Jojo de la Victoria. Jojo and I laughed at it. We even joked that if the killers wanted, they could give the 1 million pesos to our families and we would take care of it ourselves.

Forty-eight hours later, in the afternoon of April 12, 2006, an active duty policeman, acting as a hit man, went to Jojo’s house south of Cebu City. As he was about to enter his home, Jojo was shot six times with a .45 caliber handgun, in front of his son.



Guardian of the Sea and my buddy Jojo de la Victoria was murdered in his home in front of his son.

For once, tears flowed from my broken heart. Broken, but unbeaten. Jojo's death only fueled the fire of my passion and that of my team. Three weeks after we buried Jojo, we raided another island notorious for being the hotbed of illegal fishing. Our efforts were the subject of a documentary film entitled *Blast* by the British Broadcasting Corporation (BBC).

What is even more surprising is that I was doing all this without any funding, and while being generally jobless. Where did I get all the money to do that? Frankly, I don't know. I never think about money. I only think about what I want to do, and money (I call it Water) looks for me.

Did we wipe out illegal fishing? No. If at all, we only prevented it from getting worse. At least in my area of the Visayan Sea, we put a little brake on blast fishing. But illegal commercial fishing persists today.

A touch of kindness. With the threat upon my Life and my family, a friend from the United States showed a great gesture of kindness. He cashed in some of his savings to send me a check. He knew I was sailing in very stormy Seas. And he cared enough to give me the paddle to row and ride out the storm.

More than the amount, the gesture of kindness and of caring and sharing touched my heart beyond words. Instead of using it for myself to hide and to keep my family safe, I decided to make the gift go farther. I used it as the seed fund for a greater good. To honor my fallen friend Jojo, I founded the School of the SEA (Sea

and Earth Advocates) in the beach place I had on Bantayan Island. I envisioned it to be a training center for people who dare to care for the Sea and the Earth. A wonderful dream. So I put up a wonderful structure made of native materials (bamboo, palm leaves, and coconut lumber). Its light materials were very appropriate to the island's tropical climate conditions. It was an architectural piece of art. In May 2007, we held a fun opening of the School of the SEA.



The School of the SEA before (above) and after (below) Typhoon Frank.

One year later, in 2008, an extreme weather event happened. Typhoon Frank poured extraordinarily heavy rain on Bantayan Island. Every structure on the island made of native materials collapsed under the weight of the heavy rainwater. Rain that should have fallen in weeks poured in one day. The entire School of the SEA, barely a year old, collapsed. Boom! There goes my dream school. It was my first taste of an extreme weather event. Maybe, the climate is in crisis.

But that seed planted by a gift of kindness has since grown into a bigger dream. After a short effort to be a School of the SEA, we went back to being the SEA Camp. But now, it bears a more descriptive meaning: Sea and Earth Advocates of Culture, Arts, and Music for the Planet. You can see the short film of our April 2018 re-inauguration.⁸

Thank you ever so much for that seed of kindness to the mentor of mentors, the guru of gurus, and a guiding light in the stormy Sea of Life: environmental law scholar with a giant heart, Nicholas A. Robinson.

Climate of change. When I wrote the article on climate change and soft energy in 1989, climate change was only a scientific theory. Although there was growing evidence that it was happening, no one really understood it.

I pretty much forgot about climate change for the next twenty years. I spent those years trying to use the law to fight the abuse against the forest and the Seas. Using the law to care for the Land, Air, and Waters of Life.

In 2007, I was invited to attend a conference on climate change at the National University of Singapore with my esteemed friends and environmental law scholars Koh Kheng Lian and Lye Lin Heng. Nick Robinson also attended.

To give context for the Singapore meeting, I measured the front yard of the beach house that I built in 1994. While the law only required an easement zone of twenty meters from the high-water mark, I made my house forty-five meters away from the Sea.

In 2007, merely a decade later, the distance from the house to the Sea had shrunk to only twenty-five meters. Scientific evidence showed that there has been only a two-inch rise of the Sea level. When I saw that, I realized that Sea level rise is most probably real.

What if the Sea level rises to six inches? Or twelve inches, or twenty-four inches, or more?

Montreal Protocol. In the year 2007, my longtime buddy and international environmental lawyer par excellence Durwood Zaelke invited me to join him on the journey of taking on climate change. He asked me to help represent the Federated States of Micronesia (FSM), a country of many islands floating somewhere west of the Pacific Ocean. We had something in common: the Sea was eating up our island homes.

Here is the greatest challenge in the science of climate change: The steps between the causes and effects are too many and too difficult to connect for the ordinary mind. We can take only one or two thinking steps at a time. Unlike Air and Water pollution, deforestation, and other clearer environmental issues, the effects of climate change cannot be seen right away. Why is the climate emergency so difficult to understand?

*Things that today make our lives comfortable,
Will tomorrow make our lives miserable*

Try explaining climate change to ordinary people. Try making them understand how climate change is caused by the electricity that lightbulbs use to make their evenings bright. Try explaining how the motor vehicles that bring them where they want to go, the air conditioners that cool hot days, and the heaters that warm the cold are all related to the climate crisis. Try explaining how the cows that give them the meat that they eat, the methane from the rice that is a staple of so many people, and all the conveniences and comforts of modern Life are the very causes of this climate crisis. Good luck. I am confident that you will only see eyes grow bigger in disbelief.

In 1974, researchers at the University of California, Irvine, reported their discovery that certain man-made chemicals, the tongue-twisting chlorofluorocarbons (CFCs), damaged the umbrella of the Earth: the ozone layer.⁹ After some convincing, the world responded in 1985 with the Vienna Convention for the Protection of the Ozone Layer. This would be the framework for the Montreal Protocol on Substances that Deplete the Ozone Layer (MP), signed in 1987 and put into effect in 1989. The MP is the international environmental agreement that phased out ozone-depleting gases.

The Montreal Protocol is known as the most successful international environmental law. In thirty years, it has significantly reduced the use of ozone-depleting CFC gases. It is a remarkable achievement. But, before we pop open the bottle of champagne, consider this: The gases used to replace CFCs were effective, but they had a terrible side effect. They are thousands of times hotter than carbon dioxide. They are called hydrofluorocarbons (HFCs).

Environmental litigator Durwood Zaelke and his small but savvy team of scientists, lawyers, and public citizens worked behind the scenes to push for the reduced use of HFCs.

It was a very long and tedious journey to take on. I saw first-hand how slow, tortuously painful, carbon-costly, and time-consuming is the world of international environmental politics and diplomacy. It took all of seven years for the state parties to agree to reduce the use of HFCs in the landmark Kigali Amendment to the Montreal Protocol in 2016.¹⁰ Implementation of the agreement will take many more years.

Though by the standards of international environmental politics, the Montreal Protocol came together very fast. Consider the long path of the Climate Convention. In 1992, the UN Framework Convention on Climate Change was passed in Rio de Janeiro. In 2015, we got the Paris Agreement. After almost twenty-five years, all the state parties did was to agree that the problem is real and that it needs to be solved.

Remember what we said about how fickle governments are? In 2016, a new president took over leadership of the country that is the biggest source of climate-heating gases. All by himself, he withdrew from the Paris Agreement. Poof!

International environmental politics is grounded on a country's self-interest, mainly economic interests. What I have seen is that to prepare for the climate emergency, international politics is not the best arena for rapid response and effective action. We probably need an immediate emergency of global proportions to reduce the use of oil and other climate-heating sources. Recently, the Philippines faced one such real, clear, present, and immediate emergency.

After the School of the SEA collapsed from the rains of Typhoon Frank in 2008, I started slowly rebuilding. Rising from the ruins, with my own meager means, we tried to train more students, teachers, and citizens.

Then came November 8, 2013. Then came Typhoon Haiyan (local name Yolanda), the most powerful typhoon to ever hit landfall. It breezed through the Visayan Region of the Central Philippines, and dropped by Bantayan Island and the School of the SEA. All our ten structures – mostly made of native materials – must have been so architecturally sound that we were not damaged by Typhoon Yolanda.

We were erased.



The resulting damage to us was mind-blowing and game-changing. The utter destruction, Water shortage, extreme heat and mosquitoes, and the general sense of hopelessness and helplessness must be a foretaste of things to come.

If climate change is real, the world must know about it, must try to do something about it, and must be prepared to face it.

It is time to tell another story.

*Though nothing can bring back the hour
Of splendor in the grass, of glory in the flower;
We will grieve not, rather find
Strength in what remains behind.*

—William Wordsworth, *Ode: Intimations of Immortality*

Legal mischief. How can we tell a story to the world? If we wrote a book, who would read it? How can we tell the story that the symptoms of this deadly virus called climate change are real, clear, present, and immediate? How can we present proof that the fires in Australia, the Amazon, and California in 2019, the heat waves, the strange weather, the Water shortages, the rapidly melting ice of the Arctic and Antarctic, the rising Sea levels, the ocean acidification are only the beginning?

At the end of 2019, another deadly virus appeared and forced the *Homo* virus to stop and do nothing. The huge silence it introduced gave us space to begin to understand ourselves. If only for that, thank you, COVID-19. For a moment, the world is staying at home, the roads are empty, the skies are clear, the Waters are clean, and the planes are grounded. If we do not learn from this experience, perhaps we will kill off the species that is causing all the problems of the world. But if we do learn, then that is when everything will come to Life.

*If we were not so single-minded
To keep our lives moving
And for once, do nothing.
Then huge silence and interrupt this sadness
Of never understanding ourselves.
And then the Earth can teach us,
That when everything seems dead.
That is when everything comes to life.*

—Pablo Neruda, *Keeping Still*¹¹

Back in 1996, while learning how to sail on the Charles River in Boston (and pretending to earn a master of laws nearby), I wrote a paper for a course on international environmental negotiation. Instead of writing on the topics

assigned, I decided to write about something else. I asked myself the question: how can we use law to spark awareness and action to face a global environmental issue? Since it was a class on negotiation, and not on litigation, I got my lowest grade. That is very OK. After all, I was not there for a master of laws (LLM); I was there to start my LMM: legal mischief making.

The idea of legal mischief making lingered on. After the 2008 collapse of the School of the SEA due to an extraordinary typhoon, I started taking action. In January 2009, kindred spirits and I came together to plant the seed of a global legal action on climate change. The plan was to prepare a template of letters and petitions, well-grounded on law and science, to send to government officials and urge action. The letters would also offer the government the support of citizens for strong, serious, and sustained action to face, and embrace, the climate crisis.

That same year, there was an awards ceremony for the Asian version of the Nobel Peace Prize: the Ramon Magsaysay Award. The selection committee must have committed a serious typographical error because they gave it to a CBB: certified beach bum.

Instead of just talking Air at the awards ceremony, we launched the 10 Million Movement (10MM). The idea was that all change must begin within. We aspired to get at least ten million personal commitments to change the wasteful ways of this human virus. These are simple things like turning off lights and gadgets when not in use, not wasting Water, and carpooling. In other words, the idea is to be “the change that we want to see.”

Of course, the goal of ten million pledges for personal change was ambitious, audacious, and almost ridiculous.

With the help of a friend who had more tech skills than I, we launched the movement. I was excited, but realistically, if we got even one hundred personal pledges for change, that would have been worth it.

Fourteen days after the launch, I was told that the website had collected quite a few more pledges than that. In two weeks, we had *twelve million* pledges of personal change. This was 2009, before social media. If it could be done then, can we do it now? Can we change faster, better, and longer?

I *Am Climate Justice*. The idea of using law to spark action is unfolding as the I Am Climate Justice (ICJ) Movement.

I Am Climate Justice. What? Does that make us Marvel superheroes? A member of the Avengers? No, it only means that in each one of our fingers lies the power to give the present and future generations the Earth they deserve. That is what justice is: giving people what they deserve. If we do not waste Water today, we will have Water to drink tomorrow. If we turn off lights and gadgets when not in use, we save a lot of energy; then electric power companies will burn less coal, oil, and gas. Demand-side management, which a long time ago

in my conversations with the Sea in Bantayan Island, I called the “need contraction theory.” Reduce your “needs,” and you will never want for what you really need.

So long as we continue to use cars and burn gasoline, people will produce them to make money. Note that cars have a very high carbon cost. It ranges from the mining of ore to make steel, the scraping of mountains for the rocks to build roads, the cutting down of native forests to plant rubber trees for tires, mining and refining oil to make and burn gasoline and diesel in the infernal combustion engines. We pave living Land with dead concrete to make the roads. We burn so much of what took hundreds of millions of years just to move ourselves from one point to another. So long as we continue to waste electricity in our homes and buildings, such as those big buildings in New York and other major cities where lights are on twenty-four seven, people will always burn more coal to produce electricity. To paraphrase an Asian wise man, Gandhi: There is enough for every one to use. But there will never be enough for any one to waste.

It is much like the demand for illicit drugs in America. The United States spends billions of dollars to fight the drug lords in Mexico and Colombia and their U.S. distributors. But so long as the demand for coke is there, the supply will always find a way to its customers.

Cut the demand, the supply will shrink. The ongoing COVID-19 crisis is a perfect example of reduced demand. For once, the price of oil tanked into the negative, as oil producers paid to store the barrels of oil that consumers did not need.

So what does the ICJ have to do with this?

Again, I Am Climate Justice is a movement to be the change that we want to see. It is a movement mainly of young people who are very concerned about their future. It has two levels: the local and the international. At the local level, it has two dimensions:

1. Individual. For change to happen, it must begin within. People who wish to join the movement must pledge to be the change. They must shun waste: of Water, electricity, fuel, plastics, and so on.
2. Collective. People who wish to join the movement have three game-changing interventions that they can accomplish by cooperation:
 - a. Food gardens. Members of the movement can plant and grow vegetables in their own homes and along public spaces. By doing this, they will reconnect to the Land, Air, and Water. In addition, of course, they will reduce the cost of food. While this seemed impossible when I first suggested it in my book *Shooting Stars and Dancing Fish* many years ago,¹² today, with everyone on “house arrest” for several months to reduce the spread of COVID-19, people are discovering the beauty of growing their own food.

- b. Road sharing. *Those who have less in wheels must have more in roads.* Roads are meant to move people, not cars. Again, empty roads, wide walkways, and cycling paths seemed impossible for a car-crazy and fuel-foolish society when I suggested them in *Shooting Stars and Dancing Fish*. But today, with social distancing being part of the narrative of the COVID crisis, walkways and bike lanes are popping up in many cities around the world. Bravo.
- c. Rain catching. With more frequent and severe heat waves and droughts, access to fresh Water is the first major human concern of the climate crisis. Why waste precious rain? Why not collect them in reservoirs and catchment basins? Singapore is an excellent example of this wise use of rainwater.

The above interventions are game-changing. The more sophisticated word is *catalytic*, meaning that these are actions that will spark a series of other actions leading to the desired end goal.

At the international level, ICJ refers to the highest court of the world: the International Court of Justice. It is there that the young people of the world would like to tell their story and, perchance, light a STAR.

Lighting a STAR. A legal action lights a STAR: It tells a Story. It puts the issues on the Table for orderly discussion. It will spark Action. And sooner or later, one way or the other, win or lose, there will be a Resolution.

There are still deniers (and inflamers) of the climate crisis. Fine. Let us put the issues on the table for proper discussion, backed by evidence. We will send them summons to appear in the highest court of the world. This is called an “Invitation” to a state by the International Court of Justice. Let us give them their day in court, let us hear their story and listen to them justify their position. Wouldn’t it be fun to see them twist and turn, squirm and sweat in the witness box while being cross-examined by the best trial lawyers in the world?

But no, this will not be an adversarial action using the might and majesty of the law. It is not us against them. This legal action for future generations is a simple request for the advice of the International Court of Justice: an advisory opinion. It is meant to tell another simple story.

The question to be asked will not point fingers of blame nor pick a fight. It will instead ask all countries and peoples of the world: “In this climate crisis, what are the duties of states to future generations?”

Let’s pause to reflect on the words. The word *crisis* has two meanings: danger and opportunity. We see the clear and present dangers. We can also see the chance for a real and lasting climate of change. *Duties* are responsibilities grounded in law and basic truths in the story of humankind. *States* refer to the imaginary beings that we humans have invented to look after our common good. In political theory, the state is a legal fiction that is supposed to be the *bonus paterfamilias*: the good

father of the family of humankind. *Future generations* give the question a moral dimension. We have children, grandchildren, nephews, nieces, and young friends. Will they still have Water to drink?

Thank you for your insights on the phrasing of the question, Ambassador Stuart Beck.

The UN General Assembly must pass a resolution by majority vote to ask the ICJ for the advisory opinion. That is where the fun begins.

The end goal of this game is not just a UN General Assembly resolution. It is not only to tell a story in the International Court of Justice. The end goal is to give a chance for people to take action – in their individual and collective capacities – for a real and lasting climate of change.



Law students and young lawyers filed a petition to the Philippine Mission to the UN requesting an ICJ advisory opinion on the obligation of states to reduce greenhouse gas emissions, September 24, 2019.

The young are taking action. The voices of the youth are now being heard around the world. That is wonderful. Greta Thunberg and your generation, carry on!

You have the greatest stake in what will happen to the Life-sources of Land, Air, and Waters that will be available in your time. You have all the right to call out our generation's reckless gambling of your future. We are greedily using and abusing these Life-sources that took all of 4.5 billion years to become what they are. Remember the story of my grandfather?

In a series of bold moves in September 2019, two groups of young people filed legal actions in the UN. On September 23, Greta and company, backed by a crack team of legal eagles, filed a petition to call out the violation of children's rights. Good job! The day after, September 24, another group of young people – law students and young lawyers from around the world – filed a memorable petition. It was submitted to the Philippine Mission to the UN to request the United Nations General Assembly for the ICJ advisory opinion. A few days later, they filed the same request with the Pacific Island nations of Kiribas and Vanuatu.

Will that petition end up in the UN Missions' garbage cans? Or will it move through the hallowed hallways of the United Nations and find its way to the International Court of Justice? *Que sera, sera.* (What will be, will be.) What is important is that these young people have awakened to the dangers of climate change, and are now aware of their powers to take action for a real climate of change. It is also a little piece of play to use the law as a medium in the art of storytelling, and as a tool for global mobilization. And it is a modest but bold attempt to use the law as a matchstick to light the candle of courage and the flame of hope.

In the local arena, a number of legal and metalegal tactics can be used to tell a story and, hopefully, spark action. Dozens of legal actions are now being filed around the world. Among the best known are the *Urgenda Foundation* case in the Netherlands and *Juliana v. United States*. Win or lose, the storytelling is both the journey and the joy.

In the Philippines, we are exploring an untried legal approach: to file a petition to perpetuate evidence. We can put on record scientific evidence and prove beyond reasonable doubt that the climate crisis is real, clear, present, and immediate. We can also put on record evidence of what government and people are doing (or not doing) to face the emergency.

Again, the case is not intended to make enemies. We only plan to take down the evidence present today. Using the power of the stationery – the letterhead of a court of law – petitioners can ask questions to their public officials.

If the government officials are doing good, we will nominate them for recognition and commendation by the Normandy Chair for Peace (NCP), by the United Nations, and by the Guardian of Future Generations (GFG).¹³ We will shine the spotlight on the good, the right, and the bright. This will help continue the good work they are doing beyond the short terms of their offices. Hopefully, it will ensure continuity.

If government officials fail, neglect, or refuse to cooperate, this will be evidence put on record. It can be preserved for future reference in case future generations wish to take action in a court of law.

This is called the candies-and-needles approach in the science and art of legal marketing. Do what is right, and you will receive the candies of congratulations and recognition. If you do not do anything, the evidence will be put on record in a

court of law. The sight of a long and sharp needle piercing one's neck in the future is a sight one does not like to imagine. The threat of pain can often be more painful than the pain itself.

It is time to shift from the harsh energy of enforcement and move to the happy energy of positive reinforcement.

Todo es según el color del cristal con que se mira.

It depends on the color of the lens we use to look (at it).

—Ramón de Campoamor

The story we want. Going back to the title: what is the story? I have tried to tell a few stories. But the real story will be told by you, dear friend, and what you will do after reading these stories.

It is also about how we look at the world. We can look at it through dark lenses and see only the gloom and the doom. Or we can look with bright-colored lenses and see happy energy. It is time to transform today's doom and gloom and tomorrow's happy boom and flowery bloom.

Normandy Chair for Peace

*We will have Peace on Earth when we have Peace with the Earth.*¹⁴

Normandy, once a symbol of war, is now a symbol of peace. On June 5, 2019, a World Peace Forum was held in Normandy, France. It coincided with the seventy-fifth anniversary of the Normandy landings on D-Day, the massive invasion of the Allied forces against the tyranny that then gripped the free world. On that day, June 5, which also happens to be the UN World Environment Day, the visionaries founded the Normandy Chair for Peace. That symbolic chair may well be a beginning of the fusion of two powerful global movements: the peace movement and the environment movement.

After all the bruises of battles and wounds of war, I learned that the best form of law enforcement is when the law does not need to be enforced. That is when people have absorbed the spirit of the law.

Law and science try to change the mind. When you change the mind, it can change tomorrow. But when you change the heart, it is forever. How?

The greatest human hunger is not the hunger for food. It is the hunger of the human heart for approval.

The NCP is but a symbol of peace on Earth – by having peace with Earth. It is a seat on which those of us who believe in this truth are welcome to rest and enjoy. The NCP takes on a new and happy path to send its message to the world. We will cooperate with all those interested to search for the good, the right, and the bright. The Good Stories Movement seeks to tell these stories to inspire and set the hearts of the world on fire.

Ninety-nine point nine percent of what happens in this world is not bad. It is neutral and, in fact, much of it is good. Even in this seemingly dog-eat-dog world, countless acts of kindness and goodness happen every single moment of the day. But why do we hear and read only of the 0.01 percent that is bad news? Because bad news sells?

It is time to change the story! Law and punishments are weak drivers for good conduct. The best drivers are called hope and inspiration. Hope springs eternal, and inspiration is the fuel for the fire of desire.

The seeds of goodness live in the soil of appreciation for goodness.

—The Dalai Lama

We will search for the good stories of people facing and embracing the crisis of climate and of Life on Earth. There are a good number of movements along this line, such as the Equator Prize, Earth Champion, Blue Planet, and many more. They are very selective and prizes are awarded only once a year. Building upon these movements, the Normandy Chair for Peace will try to spread the seeds of goodness by watering them with the appreciation of goodness.

Guardian of Future Generations

The International Council of Environmental Law (ICEL), the first international group of lawyers, professors, and jurists focusing on environmental law was founded in 1968. Through its Executive Governor Nick Robinson, this SOB (son of the beach) was recently honored with the title of Guardian of Future Generations.

Synergizing this position with the Normandy Chair for Peace, the Guardian of Future Generations will work toward a change in the MAP of the world: that is, mindset, attitudes, and practices.

The Guardian of Future Generations will invite reports by citizens of good stories and best efforts. There are countless good stories now being written by ordinary people and even by governments to have peace with the Earth.

Recently, I had another awakening. I realized that we must begin to change the story. We can do this by changing the storyline. Together with like-hearted friends, we launched the People's Gratitude Movement in the Central Philippines in March 2017. This is now evolving into the Good Stories Movement.¹⁵

*When you criticize,
Speak in secret.
But when you give a kind word,
Shout it to the whole world.*

We hope to cooperate with international, regional, national, and local volunteers to search and shine the spotlight on the good, the right, and the bright. The

Normandy Chair for Peace and the Guardian for Future Generations will continue to take the following actions:

1. We prepare a letter of congratulations and commendation, signed by the NCP, the GFG, and a roster of international luminaries. We send that letter-commendation to the person(s) concerned. Copies will be furnished to their superiors, if any, and to family members, local and national officials, even to the heads of states to which the person belongs. The letter and their work will hopefully find their way to mainstream and social media.
2. We hope to hold conferences in the six regions of the world: Latin America, Africa, Europe, Asia, North America, and Oceania. The purpose is to showcase the good stories and share the lessons learned by the people making peace with the Earth. Hopefully it will inspire others and multiply the seeds of growing goodness.

*Kind words do not just praise the goodness of others.
Kind words have the power to change
The destiny of the world.*

There are ways of making people wake up to the urgency of the climate crisis. First is for them to run out of Water, or die by fire and heat, or drown in floods and storm surges.

They must feel the extreme pain and suffering in person and up close. The human population is overdue for pruning. It will come in three general forms: disease, famine, and war. Disease comes with the abuse of nature, such as by eating wild animals or factory farming animals that can transmit disease to humans. The COVID-19 crisis is a good example, and it is showing us now how to be better than we are. Famine follows the loss of fresh Water. And violence will result in the competition for the remaining Life-sources of Land, Air, and Water.¹⁶



Do we deserve our name, *sapiens* (wise)? Can we be a force of nature for strong, serious, and sustained action to nourish Life and the Land, Air, and Waters of Life? Can we face with wisdom and courage this chance for a climate of change?

The storytelling will not be done by me, nor by you, nor by them. It will be told by ALL of us: working together, walking together, laughing and loving together in this journey of a dream.

Together, we will walk to the world we want.

ABOUT THE AUTHOR

Antonio Oposa Jr. is one of Asia's leading voices in the arena of environmental law. Fighting to protect the Philippines' natural patrimony, he has initiated landmark cases to protect the country's remaining virgin tropical forests and clean up Manila Bay. He has also organized and led enforcement operations against environmental criminals. As a founder of SEA Camp (Sea and Earth Advocates), an experiential learning center, he has trained thousands of children, teachers, government officials, fishermen, law enforcement officers, lawyers, and citizens for sustainable living.

ENDNOTES

- ¹ I capitalize Land, Air, Water, Sea, and Earth throughout the essay, out of respect for their necessity to Life.
- ² Published in the *Manila Bulletin* in September 1989.
- ³ Tony Oposa, "The Joy and Journey of Jun (Factoran)," Normandy Chair for Peace blog, April 22, 2020.
- ⁴ *Oposa v. Factoran*, G.R. No. 101083 (1993).
- ⁵ Tony Oposa, *Shooting Stars and Dancing Fish: A Walk to the World We Want* (Cebu City, The Philippines: Ramon Aboitiz Foundation Inc., 2017), 159.
- ⁶ Antonio A. Oposa, *A Legal Arsenal for the Philippine Environment* (Muntinlupa, The Philippines: Batas Kalikasan Foundation, 2002); and Antonio A. Oposa, *The Laws of Nature and Other Stories* (Muntinlupa, The Philippines: Law of Nature Foundation, 2003).
- ⁷ See *The Visayan Sea Squadron Enforcement Operations: Striking at the Root of the Problem*, video, Lattitude Productions, 2004, <https://drive.google.com/open?id=1q5Sei4c-aGWJnQ1xCmdriBaQVumPSnQm>.
- ⁸ See *SEA Camp: Sea & Earth Advocates of Culture, Arts, and Music for the Planet*, video, SEA Camp, 2018, <https://drive.google.com/file/d/14cmeo932x6CUTLHxlCU01CMBMssgmWto/view?usp=drivesdk>.

- ⁹ Mario J. Molina and F. Sherwood Rowland, “Stratospheric Sink for Chlorofluoromethanes: Chlorine Atom-Catalysed Destruction of Ozone,” *Nature* 249 (5460) (1974).
- ¹⁰ “Tony Oposa is a gifted storyteller. He used his gift to reframe the importance of phasing down HFCs from a technical issue to a moral issue. This helped win many Parties over to support what became the Kigali Amendment to the Montreal Protocol. I can’t think of anyone else in the world who would have been able to do what he did.”
—Durwood Zaelke
- ¹¹ Author’s translation.
- ¹² Oposa, *Shooting Stars and Dancing Fish*.
- ¹³ See below for more on the Normandy Chair for Peace and the Guardian of Future Generations.
- ¹⁴ This is a variation on David Brower’s expression.
- ¹⁵ See Good Stories Movement, “Good Stories Movement: Planting Seeds of Goodness,” August 4, 2020; Good Stories Movement, *The Good Story*, video, <https://drive.google.com/file/d/12sHSTDOodhYRfsDPZSswstydqMuS666qQ/view?usp=sharing>; and *Whisper of the Wind*, video, written by a fourteen-year-old boy and native of Bantayan Island, Cebu, The Philippines, with music by Alvina Sy and Homer Flores and vocals by Anna O., Carina Reyes, and Dondi Ong, https://drive.google.com/file/d/183_QH3oUbbgUPoC9o026BUG4HbnkR1U7/view.
- ¹⁶ “Letter Written in the Year 2070,” originally published in *Crónicas de Los Tiempos*, April 2002, <https://docs.google.com/presentation/d/1cGO8XK4AyIRu4jOd2zfNgor-sbt2D-os/edit#slide=id.p1>.

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Inside back cover: Leonardo da Vinci (1452–1519), *A Deluge*. Black chalk on a sheet of paper; 15.8 cm x 20.3 cm. This is one of a series of eleven drawings by Leonardo of a cataclysmic storm, of which he offered this description:

The air was darkened by the heavy rain whose oblique descent, driven by the rush of the winds, flew in drifts through the air. . . . But it was tinged with the colour of the fire kindled by the thunderbolts by which the clouds were rent and shattered, and whose flashes revealed the broad waters of the inundated valleys . . . forming a shore to the swollen waters of its river, which, having already burst its banks, will rush on in monstrous waves, and the greatest will strike and destroy the walls of the towns and farms in the valley. The ruins of the high buildings in these towns will throw up a great dust, rising up like smoke or wreathed clouds against the falling rain.

Leonardo da Vinci, *The Notebooks of Leonardo Da Vinci*, Chapter IX: The Practice of Painting, translated by Jean Paul Richter. Image courtesy of the Royal Collection Trust.



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