

Earth 2020

An Insider's Guide to a Rapidly
Changing Planet



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Introduction

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Philippe Tortell

On 22 April, 1970, millions of people took to the streets in cities and towns across the United States, giving voice to an emerging consciousness of humanity's impact on planet Earth. This first Earth Day was the brainchild of US Senator Gaylord Nelson, and was organized by a grassroots movement coordinated by Denis Hayes, a twenty-five-year-old Harvard student. The Earth Day events included demonstrations, teach-ins and community clean-ups ('Trash Wednesday') in over 2,000 communities across the country. Protesters shut down Fifth Avenue in New York City, while students in Boston staged a 'die-in' at Logan airport, lying in coffins to raise awareness about the dangers of airplane-related pollution. Demonstrators in Chicago called for an end to the internal combustion engine. The protesters were mostly white, middle-class and overwhelmingly young, but their message also reached some in the older generation. Walter Cronkite, by then widely seen as the most trusted man in America, hosted a half-hour Earth Day special on the CBS Evening News. He had become increasingly concerned about 'the fouled skies, the filthy waters and the littered earth', as he put it, and he concluded the news special with a call for the public to heed 'the unanimous voice of the scientists warning that half-way measures and business as usual cannot possibly pull us back from the edge of the precipice'.

Today, half a century later, Cronkite's words are eerily familiar. Since the first Earth Day, we have, no doubt, made significant progress in addressing a range of acute environmental problems. Yet, other more pernicious threats have emerged, from climate

change to global biodiversity loss; the warnings seem louder, and the edge of the precipice ever closer, as growing evidence demonstrates planetary-scale human perturbations of the Earth System. As we look back to the first Earth Day fifty years ago, understanding the environmental trajectory of planet Earth, and the societal evolution of its most dominant species — humans — provides us with important lessons from the past, and, hopefully, insights for the future.

Such lessons and insights are gathered together in the present collection of essays, which mark the fiftieth anniversary of Earth Day in 2020. The idea for such a collection first came to me in January 2019, just a few months after I had resigned as Director of the Institute for Advanced Studies at the University of British Columbia (UBC). It was a job I had held for the better part of three years, during which I had worked with scholars from across the university and around the world, fostering inter-disciplinary research on a wide range of topics. As part of this work, I had co-edited two collections of essays, *Reflections of Canada* and *Memory* marking, respectively, the 150th anniversary of Canadian Confederation in 2017, and the 100th anniversary of the end of WWI in 2018. These projects brought leading scholars together to share their insights on those historical milestones, in lively and accessible prose aimed at a broad audience. Anniversaries, I had learned, provided a valuable opportunity to focus public attention (if only for a short while) on topics of significant importance.

As I resumed my duties as a full-time professor of oceanography at UBC, I found myself with a sense of restlessness, and a desire to think beyond the bounds of a single academic field. During this time, I stumbled across the Earth Day network (<https://www.earthday.org/earth-day-2020/>). I was well aware of Earth Day, and had even (at least some years), participated in the event in some small symbolic way. I recall more than once sitting around a candle lit dinner table with friends as we turned off the lights for the prescribed hour. Maybe some of my neighbors did the same; maybe not. It was a ritual nod to our environmental consciousness, but we had little understanding of the origins and historical significance of this event, which had begun two years before I was born.

And yet, I and many others had become increasingly concerned about a range of growing environmental problems. During the mid-1990s, I was a PhD student in the US

when the UN's Intergovernmental Panel on Climate Change (IPCC) released its Second Assessment Report, which asserted, for the first time, strong evidence for a discernable human impact on global climate.¹ This report galvanized many around the world, on all sides of the debate. On the one hand, scientific advances and rapidly increasing computer power were providing fundamental new insights into global climate dynamics, and vastly improved predictive capabilities that enabled us to glimpse into the possible future of our planet. On the other hand, powerful forces were marshaling against science, backed by well-funded industry groups with vested interests in the status quo, who sought to exploit legitimate scientific uncertainty to argue against meaningful climate change mitigation. During my third year of graduate school, in 1997, the nations of the world developed a joint framework to limit global greenhouse emissions under the Kyoto Protocol.² This landmark agreement continued the legacy of the Earth Summit in Rio just five years earlier, and represented the first steps towards tackling climate change. Unfortunately, the aspirations of Kyoto (and Rio, for that matter) unraveled quickly; about two months before I obtained my PhD, in the spring of 2001, US President George W. Bush announced that the US would not implement the 1997 Kyoto Protocol. Many other nations soon followed suit, signaling the death-knell of the agreement. Over the short span of my graduate education, I had witnessed a radical shift in global environmental politics.

The following year, in 2002, I began a research and teaching career at UBC. Among other things, my work focused on understanding the potential effects of rising ocean CO₂ levels (and decreasing pH) on the productivity of phytoplankton (microscopic plants at the base of the marine food chain). Over the next fifteen years, I conducted ship-based studies of the global ocean, from the tropics to the poles, including multiple research expeditions to the Arctic and Antarctic regions. These experiences left a strong impression. I witnessed, first hand, the human footprint on marine ecosystems; from rapidly retreating glaciers and sea ice, to warming and acidifying ocean surface waters, and plastic debris floating thousands of kilometers from the shore. At the same time, interactions with my colleagues across a range of disciplines at UBC deepened my understanding of the changes that were rapidly unfolding across other parts of the Earth System, including agricultural lands and forests, wetlands, lakes and rivers. And I also knew that society was evolving, with

increasing awareness of growing environmental challenges, and shifting narratives around sustainable resource use and meaningful engagement with Indigenous peoples. In British Columbia, where the economy is strongly dependent on extractive resource industries (mining, forestry and, increasingly, natural gas), there was much debate over how to balance economic development with environmental stewardship and reconciliation with First Nations, on whose traditional lands much of the province's resource base is located.

Once I had decided to assemble an Earth Day-themed book, I began by looking back to the late 1960s and early 1970s, trying to better understand the historical context that led to the events that unfolded on April 22, 1970. Highlights included reading the original series of three *New Yorker* articles where Rachel Carson first published excerpts of her classic environmental book, *Silent Spring*,³ and watching the thirty-minute CBS News Earth Day special with Walter Cronkite. As I was learning more about the history of Earth Day, a visiting colleague also pointed me to the 1971 book, *Patient Earth*, by John Harte and Robert Socolow.⁴ The book provides a remarkably prescient and in-depth examination of early thinking around the nascent field of environmental science, with chapters on a range of topics, including human population growth, resource scarcity, nuclear power, land-use conflicts and steady state economics. I wondered what such a book would look like, had it been written fifty years later, in 2020. And so, taking inspiration from *Patient Earth*, and from my own experiences at the Institute for Advanced Studies, I sought to better understand, from a wide range of perspectives, how Earth's biophysical systems had been impacted by anthropogenic activities over the past half-century, and how society had evolved to mitigate (or perhaps exacerbate) the human environmental footprint. From this starting point, I quickly arrived at a number of topics, and sought world-leading experts from many disciplines who could address these with authority and eloquence. The response from prospective authors was overwhelmingly positive; almost everyone I contacted agreed to contribute to the project. The result is the collection of ideas and words you now hold in your hands (or read on a digital screen).

From the outset, the thematic structure of the book was clear enough. I asked all authors to reflect, from their own vantage point, on how Earth and its human inhabitants

had changed over the past fifty years, and what the future might look like another fifty or more years down the road. The contributions fell naturally into several groups. Some authors examined biophysical components of the Earth System, from the atmosphere (Jon Abbatt), oceans (David M. Karl) and fresh waters (Janet G. Hering), to glaciers (Julian Dowdeswell), land (Navin Ramankutty and Hannah Wittman) and forests (Sally N. Aitken), while others examined impacts on organisms and ecosystems, presenting case studies of declining marine fisheries (U. Rashid Sumaila and Daniel Pauly) and dwindling global biodiversity, writ large (Jeffrey R. Smith and Gretchen C. Daily). Still other essays addressed the pernicious problem of long-lived wastes in the form of plastics (Roland Geyer), toxic chemicals (Elsie Sunderland and Charlotte C. Wagner) and space junk (Alice Gorman) that are a defining feature of the Anthropocene — a new geological era dominated by human influence on planet Earth. Other authors looked at the shifts in political (Elizabeth May), legal (Rosemary Lyster) and economic (Don Fullerton) paradigms that have occurred since 1970, as well as the evolving media landscape in which all of these changes have unfolded (Candis Callison) and the role of science and technology in shaping societal actions and discourse (Sheila Jasanoff).

At a global scale, there is no doubt that increasing human consumption of fossil fuels has driven a large-scale perturbation of the global climate system. One essay on carbon (David Archer) explores this anthropogenic footprint in the context of deep geologic time, while another (Elizabeth J. Wilson and Elias Grove Nielsen) examines the underlying global energy trends driving historic and potential future CO₂ emissions. A deeper understanding of the impacts of rising CO₂ on the climate has only emerged in recent decades, as shown by an essay on the historical development of computer climate models (Tapio Schneider), and essays discussing recent and possible future trends in global sea level (Robert E. Kopp) and extreme weather (Neville Nicholls). And as these impacts become ever clearer, there is increasing discussion of potential geoengineering to limit the worst potential consequences, as discussed in one essay (Douglas G. MacMartin and Katharine L. Ricke). These technological approaches represent a case of fighting fire with fire, but perhaps there are other ways to imagine the problem and its potential solutions. In this respect, long-held wisdom of Indigenous knowledge systems (Deborah McGregor) has much to teach us. At

the same time, other ‘world-views’ can be brought to bear, using audio and visual media to re-frame our world through the lens of the creative arts (Edward Burtynsky).

Despite the diversity of ideas and topics presented in this collection, there are some gaps. Global population growth is a prime example. In the late 1960s and early 1970s, rapid improvements in public health led to sharp increases in longevity that were not matched by declining birth rates, leading some, like Stanford biologist Paul R. Ehrlich, to raise awareness of an impending ‘population bomb’, as he titled his 1968 book.⁵ Today, global population now exceeds seven billion (roughly double what it was in 1970) and more than half of all the planet’s inhabitants now live in cities. But this overall population growth has been accompanied by a large demographic transition, with populations falling in some countries. In turn, girls and women have increasingly widespread access to education and reproductive controls to limit unwanted pregnancies. Even if the most direct projections in Ehrlich’s book do not come to pass, there can be no doubt that the growing human population has put an increasing burden on Earth’s planetary systems. Other topics not addressed in *Earth 2020* include the rise of global pandemics and antibiotic resistance, both of which could have significant environmental impacts on human societies. Clearly, these topics warrant further attention and research. Similarly, environmental justice, which is touched on by several authors in this collection (May, Lyster and McGregor), deserves more in-depth treatment, as climate change and ecological degradation disproportionately affect some of the world’s most vulnerable populations.

The solutions to our environmental problems cannot be siloed into distinct domains of expertise, and this is reflected in the integrated approach of many of the authors in this collection, who explore ideas that cross traditional boundaries, as well as in the structure of this volume. Instead of being organized thematically, grouped by discipline and subject matter, essays on different topics are scattered throughout the book, like stepping stones across a stream of ideas, with many possible ways to cross. But the banks of the stream — the beginning and ending crossing points — were clear from the beginning. It seemed only natural to start with an explicit retrospective (John Harte and Robert Socolow), going back to *Patient Earth* to re-examine long-standing environmental questions with the benefit of hindsight. The other side of the stream represents our unknown future. What will the

planet look like in 2070, and how will our current understanding of Earth's trajectory map onto the reality that unfolds over the next half-century? Few of the authors in *Earth 2020* will be able to answer this question; many are at, or approaching, the end of their careers, and few will even be around to see 2070. Nor will they be the ones most burdened by the environmental consequences of our collective actions over the past fifty years. For this reason, the last word must be given to our newest generation of leaders (Zoe Craig-Sparrow and Grace Nosek), those who have stepped up to demand systemic change, and who will drive the way, with our support and encouragement, to a better future.

As we look to the uncertain future ahead, it is clear that our path forward will not resemble the road we have traveled to get here. As the essays in this book demonstrate, planet Earth has changed in profound ways, and these changes will be with us for generations to come. In the face of this transformation, we must not be paralyzed by fear and anxiety. Rather, we must harness new tools and understanding, working collectively to develop innovative approaches to address many of our most challenging environmental and social problems. In that respect, free and open exchange of ideas and information is critical; we must be able to learn from each other, drawing inspiration from past successes, while avoiding previous mistakes. It seemed only natural, therefore, to use an open access publishing model for *Earth 2020*, making it freely available to anyone in the world. But wide distribution is not enough. We must also explore other multimodal approaches to engage broad audiences who feel increasingly overwhelmed in the age of information overload, where ideas compete for relevance in a crowded digital landscape. To this end, two examples of multimodality are offered as part of this volume, in the section directly following this introduction. These take the form of musical compositions drawn from a range of Earth System data; sonic representations of our rapidly evolving planet.

For much of the past year, as I have worked on this book, my own outlook on planet Earth has fundamentally shifted. For one thing, I have come to a much deeper understanding of the historical and political context that has driven humanity's impact on the planet. Through the words and ideas of the book's authors, the events that have unfolded around me over the past five decades have come into sharper focus as part of a

larger emergent narrative. And what stands out most, perhaps, is the notion of possibility. It is true that things look grim, but they also did in 1970. Our history has shown that we have the capability to address daunting global challenges if we have the will and the fortitude. In the words of the young climate activist, Greta Thunberg, delivered to the US Congress, in September, 2019: ‘You must take action. You must do the impossible. Because giving up can never ever be an option’. It is my great hope that you, the reader, will find both knowledge and inspiration in this book, and that it will mobilize you to take action in pushing society towards a more just and sustainable future.

Endnotes

1. Available at <https://www.ipcc.ch/site/assets/uploads/2018/06/2nd-assessment-en.pdf>
2. Available at <https://unfccc.int/resource/docs/convkp/kpeng.pdf>
3. R. Carson, *Silent Spring*, New York: Houghton Mifflin, 1962.
4. J. Harte and R. Socolow, *Patient Earth*, New York: Holt, Rinehart and Winston, 1971.
5. P. R. Ehrlich, *The Population Bomb*, New York: Ballantine Books, 1968.