INTRODUCTION

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"LIKE THE fury of a raging sea, a bubbly ocean of glowing sulphur, hydrogen and oxygen" arranges itself in the massive and luminous molecular nebula Messier 17, declared the European Space Agency, describing the Hubble Telescope image on the cover of this volume.[1] In this bubbly ocean, in one of the richest star fields of the Milky Way, ultraviolet radiation from young massive stars illuminates the gases' wavelike patterns by heating the surfaces of cold hydrogen gas clouds. As a result, the warmed surfaces glow orange and red, making for some of the most spectacular galactic sights. The intense heat and pressure within the nebula cause some material to stream away from the surface, creating the glowing veil of even hotter, green-colored gas that masks background structures.[2] In 1746, French astronomer Philippe de Chéseaux discovered Messier 17, also known as the Omega Nebula. He described it as "quite different from the other [nebulas]," with the "perfect form of a ray or the tail of a comet," giving rise to M17's nickname as the Swan Nebula.[3]

At first sight, the Swan Nebula is an odd example with which to start an interdisciplinary environmental humanities volume on examining toxicity across space and time—and yet, on closer inspection, the image of the radiantly glowing molecular nebula could not be more fitting. Contaminants and environmental poisons work on the human and more-than-human body through the temporal and spatial dissolution of linearity, order, rhythm, location, or containment in a way that is mirrored in the galactic spectacle. Moreover, the Swan Nebula represents a "toxic environment" that fundamentally challenges and even dissolves conservative and predominantly Western notions of space, time, timing, and speed, while inviting similar reflections—as provided in the thirteen contributions in this volume—for life on Earth.

Firstly, the Swan Nebula is located in proximity to planets with genuinely Gaussian temporalities, which—as these planets generate spacetime vortices due to general relativity—calls into question all measurements of time and place. Because of the finite speed of light, our vision of the Swan Nebula is a historic snapshot of light that has traveled through space for 5,500 years, allowing us a glimpse of a place that is at such a great distance from our planet that it would take multiple human generations to make the journey there. Multiple generations are also at stake when it comes to toxicity and contamination on our planet, as chemical contaminants exceed human and more-than-human lifespans, disrupt rhythmicities of time as organized into equal compartments, and interfere with the time and timing of cellular growth and the development of multicellular bodies and their offspring.

Secondly, Messier 17 challenges conservative understandings of place, of situatedness, and of material containment. Star formations in process, as captured in the Swan Nebula, allow a glimpse of changes of chemical substances from one aggregate phase to another. Chemical contaminants are hardly ever static. They act in combination, occur in mixtures, and undergo constant changes. Rarely can they be fully contained, either materially or governmentally, as regulations around the world differ and change over time when "pinning down" toxic contaminants as "harmful."[4]

Messier 17, thirdly, is a molecular nebula in space that is as aesthetically pleasing to the human observer as it would be detrimental to the well-being of any multicellular beings, *if they were present.* It is not only the heat or the lack of oxygen but also the radiation that would pose a serious threat to human and more-than-human health. Subatomic particles would tear at high speed through multicellular organisms' DNA molecules, splitting them or damaging their coding for cell reproduction. There is little discussion on the toxicity of outer space for multicellular life, which is precisely the point we want to stress: toxicity is an anthropocentric concept, as societies have commenced examining or governing a particular "toxic" composition of chemical particles in ecosystems only if it—directly or indirectly—concerned "them," human beings. Thinking about toxicity through the absence of human presence pushes scholars to specify what kinds of human and more-than-human body evoke compassion and care and what kinds do not.

Finally, as gases in various colors mix and mingle in our vision of the Swan Nebula, we should not forget that questions of space, time, and

embodiment cannot be neatly compartmentalized but must be understood as intersectional. How then, our authors ask, are we to understand toxic environments that not only entail a time regime of their own but also one that extends far beyond the human life span? How do we tell stories that accurately encompass the slow violence exerted by decades of exposure to toxic waste, the genomic mutations shaping the lives of the children and grandchildren of people who once worked in mining, cleaning, or pesticide-intensive greenhouses? What roles do time, space, and embodiment play in scholarly conceptualizations of the phenomena and materialities that we generally describe as "toxic"?

Toxic Timescapes: Examining Toxicity across Space and Time is an interdisciplinary environmental humanities volume whose conceptual and methodological focus seeks to explore human-environment relationships as they have played out—and continue to play out—for life on a permanently polluted planet since the twentieth century. The authors in this volume seek to tackle the methodological challenges that come with the multiplicity and intersection of different scales of time and place and to provide new approaches for the study of contamination and pollution through the concept of *toxic timescapes.* The chapters assembled in this volume offer a multidisciplinary overview of the concept, with authors coming from the disciplines of history, human geography, science and technology studies, philosophy, and political ecology. Chapters span places from Europe, North America, Australia, and the Pacific to Southeast Asia as they observe the intersection of multiple times and spaces at such diverse locations as former war fields in Vietnam, aging nuclear weapon storage facilities in Greenland, and waste deposits in southern Italy, or chemical facilities along the Gulf of Mexico and coral-breeding laboratories all across the world.

Writing on Toxicity in the Age of the Toxic Commons

These days we do not have to look far to find human-environment constellations that illustrate the urgency of this volume's contribution. Our species' excessive and expanding modes of extraction, production, and disposal—necessary to support the perpetual economic growth inherent to the modern, and particularly Western, project—and the excessive use of synthetic chemicals in all sectors of life have fostered toxicity's ubiquity

in our air, water, and soil.[5] Every year today, humans emit more than 250 billion metric tons of chemical substances, feeding a toxic avalanche that for centuries has been harming human and more-than-human life everywhere on the planet. At accelerating speed since the mid-eighteenth century, human activity has caused the contamination and pollution of our planet to a degree that François Jarrige and Thomas le Roux see contaminants as "constituent elements of modernity."[6] New synthetic chemicals were applied to control almost all aspects of life, ranging from pesticides to control ecosystems,[7] synthetic drugs to control the (female) human body,[8] and chemical weapons to control military warfare. After World War II, governments around the world started planning for World War III, pouring funds into environmental science in their search for ways to harness natural processes to kill millions of people.[9] The growing amount of waste—with more than 400 million metric tons of hazardous waste generated worldwide today[10]—illustrates another source of the increasing contamination of our planet and of the wasting of relationships of human and more-than-human beings.[11] Be they pesticides, hormone-disrupting chemicals, chemical weapons, dioxins, or nuclear waste, environmental poisons represent a ubiquitous force in the twentieth and twenty-first centuries. And yet, while the poisoning of the planet through human-made chemicals is "probably the largest human impact" to date, according to science writer Julian Cribb, it also is the one "least understood or regulated."[12]

As we live in the age of the *toxic commons,*[13] with toxicity and pollution forcefully ever present in modern daily lives, politicians, juridical systems, media outlets, scholars, and the public alike show great difficulty in detecting, defining, monitoring, or generally coming to terms with them. The struggle, we argue in this volume, is primarily one of making sense of the multiple, overlapping, and intersecting temporal and spatial scales working on the human and more-than-human body, while continuing to pay attention to the important established differentiating concepts of race, class, and gender in order to give space to aspects of (global) environmental justice and social inequality. In the broader field of the environmental humanities, scholars have primarily explored aspects inherent to the pollution of air, water, and land in relation to our modern, industrial way of life.[14] With a primary focus on the late twentieth century, studies disentangle the toxic discourses surrounding the use of pesticides and herbicides or air emission standards, or they focus on the waste from energy or resource extraction processes.[15] Authors have analyzed

public and private health issues resulting from toxic exposures and their political, social, psychosomatic, medical, and ethical implications, as well as, finally, their artistic transformations.[16] In this wealth of material, the methodological and theoretical challenges inherent to contamination and pollution, namely that contaminants and environmental poisons, and thus exposure to humans and other living beings, are not static—neither in *time* nor in *space*—have remained little explored conceptually.[17]

Toxic contaminants and their social and cultural framing are never static. The study of both must comply with a multitude of concepts of time and space that simultaneously inscribe themselves in human and more-than-human bodies and narratives while changing over time. Toxicants, such as heavy metals or radioactive molecules, can mark landscapes and their inhabitants for generations or centuries while also imprinting on the dominant framework of industrial clock-time. Stockpiles of corrosive acids, organic chemicals, toxic metals, and other wastes, for instance, pose acute, long-term health and ecological threats, causing groundwater contamination, leaching, and other types of pollution. They do so differently, in different locations across the world, illustrating the existing great economic and social disparities between, for instance, the African continent and rich industrial countries.[18] Atomic energy plants, in turn, while having long played a key role in modern societies' energy policies, to this day pose unresolved questions concerning the future management of their remains.[19]

Additionally, in the same way that toxicants can change their aggregate state from fluid to solid, some of them, such as endocrine disruptors, can also fundamentally alter human and more-than-human bodyscapes, as well as those of yet unborn future generations. The latest technologies of detection and monitoring have revealed not only that synthetic chemicals permeate bodies and ecosystems, but also that they can modify species' reproductive systems.[20] Yet, while researchers know that synthetic chemicals can interfere with the body's hormonal signaling system, legal and medical experts often struggle to establish direct causality between one concrete chemical and distinct health issues among the multitudes of chemicals we are exposed to—in particular since the effects may not show in this generation but in the next. Only decades after exposure, in 1996, did the US Agency of Veterans Affairs acknowledge a connection between Agent Orange exposure and birth defects in the next generation.[21]

Finally, the locality of toxins—whether they are found in the ground, underwater, or in the air—matters tremendously when defining their

toxicity, as does the specific social and cultural space they inhabit. Within societies and across nations, the struggle over what—and in what doses and at which life stages—makes a substance toxic and harmful has been ongoing for decades. Tons of the pesticide chlordecone, for instance, ended up as a legal substance in the French Caribbean while it was banned in mainland France. Since the 1970s, the international trade in hazardous waste has greatly benefited from an international disagreement on what substance, dose, or handling constitutes hazardous waste.[22]

As a ubiquitous toxicity in our air, water, and soil becomes an increasingly common reality and both human and more-than-human bodies are increasingly marked by the presence of synthetic chemicals, we see great potential in studies—such as those assembled in this volume—that bring into focus the intersection of time, space, and contamination as these work on the human and more-than-human body. Understanding how a multiplicity of scales—both temporal and spatial—intersects is important when discussing both intergenerational and global environmental justice. It provides a basis for thinking about long-term and future-oriented proposals of toxic cleanup and remediation, as well as for righting past exposures and assembling guidelines around responsibilities.

Toxic Timescapes as a Tool of Analysis

The concept of *toxic timescapes* refers to this intricate intersectionality of time, space, and bodies in relation to toxic exposure. As a tool of analysis, it unpacks linear understandings of time, exploring rhizomatic ways in which harmful substances permeate time and space, producing more-than-human narratives. It equips scholars with new ways of creating data and conceptualizing the historical (past, present, future) presence and possible effects of harmful substances, and provides a theoretical framework for new modes of narration in an uneven world. Thinking through toxic timescapes is an invitation to radically shift our understanding of toxicants in the complex web of life.

Toxic timescapes is a concept with epistemic variation, as the different contributions in this volume illustrate. Since toxicity, pollution, and modes of exposure are never static, their study necessarily complies with a multitude of modes of how time, space, and body relate to toxicants. Dose, timing, velocity, mixture, frequency, and chronology of exposure

matter as much as geographic location and the societal position of those exposed. Together, these factors create a specific toxic timescape that lies at the heart of one particular author's narrative, and the individual contributions in this book each look at their specific toxic timescape, ranging from marine environments to Aboriginal ontologies. Epistemically, toxic timescapes are as much personal as they are collective, as they create precedence and enable counternarratives. Moreover, when woven together, the chapters demonstrate the complex reality of toxic existence.

Our studies of the hazardous intersectionality of time, space, and body as toxic timescapes draw from multiple fields of inquiry, foremost that of history, human geography, and sociology, that have already been probing the concepts of time and space. At least since the spatial or landscape turn of the 1970s and 1980s, scholars in the humanities have gained great literacy in and familiarity with multiple and overlapping notions of space.[23] In particular, in the works of Michel Foucault, Henri Lefebvre, Michel de Certeau, and Paul Virilio, the power relations implicit in landscape were newly emphasized. These scholars did so using general headings such as "abstract space" or "symbolic place," which they then interpreted through spatial metaphors such as "panopticism."[24] Within the field of geography, scholars extended this vocabulary into theories on the relationship between power and space, using such terms as "territoriality," "power geometry," or "time-space compression."[25] The newly emerging fields of urban and environmental history put another emphasis on the materiality of distinct places, with environmental historians emphasizing that scholars need to also understand the body as a particular *place* of study. Today, the field has advanced new forms of layered analysis with the influx of digital tools such as GIS. The field of global history, finally, anchors the study of space in extrapolating the myriad relationships between local, national, regional, and global.[26]

In contrast to such a profound familiarity with studying space, scholars have a more limited understanding of the multiple formats of *time.* Although time is at the core of historical inquiries, most historians have spent much more energy on exploring *change over time* than time itself.[27] Studies predominantly follow Newton's linear time model of past, present, and future, while turning a blind eye to circular, rhythmic, or seasonal time models. Fernand Braudel and Reinhart Koselleck are influential exceptions with their concepts of longue durée, and expectation and experience as horizon, respectively.[28] As late as 2012, however,

German historian Rüdiger Graf urged that we should not presuppose time, but study it. Most recently, global historians in particular have engaged with the clashes of different social times in an increasingly interconnected world, such as that between industrial and agrarian time in the colonial nineteenth century.[29]

In the late 1980s, inspired by modern means of communication, time studies on the relationships between past, present, and future started to boom in sociology. Niklas Luhmann argued that in modern societies, the future plays a much larger role than the past.[30] In 1998, sociologist Barbara Adam widened the study of time beyond the clashes of different (human) social times by including also the timescapes of nonhuman actors. In her book *Timescapes of Modernity* she engages with the multiple time horizons of socioenvironmental life. These go beyond the temporal dimensions of calendars and clocks and recognize the multiple rhythmicities of nature, ranging from the heartbeat and cycles of activity and rest to seasonality, or the irreversible temporalities of life. According to Adam, these timescapes are in a conflictual relationship with each other and environmental hazards are inescapably tied to the successes of the industrial way of life. New methods of food production, processing, and preservation, for instance, have allowed humans to transcend their dependence on natural rhythmicity and seasonality. With globally sourced foods, industrial societies face an absolute monotony of the same chemically assisted, jet-setting foods that are available everywhere and all the time.[31] Such aseasonality comes at the expense of the health and well-being of citizens, farmers, livestock, and land, as multiple studies of the workings of pesticides illustrate, for instance.[32]

While Adam's work on time and the environment is foundational for understanding the multiple layers of relationships of human and nonhuman time horizons—at least for our conceptualization of toxic timescapes—it has received little recognition in the environmental humanities. Scholars more often cite Rob Nixon's book *Slow Violence* (2011), in which he highlights the violent implications of slowly unfolding environmental catastrophes, such as climate change, toxic drift, deforestation, oil spills, or the environmental aftermaths of war.[33] Focusing on the clash between industrial time and the often much slower processes of cell formation or bioremediation, Nixon speaks of a violence that is dispersed across space and time, a violence that is neither spectacular nor instantaneous, but rather incremental and accretive.

Similarly drawing on the notion of different speeds, those studying disasters are arguing for understanding disasters as fast *and* slow, to not only capture the disaster as an *event* but also as a *process,* since disasters emerge from longue durée interactions between human and ecological systems.[34] Finally, expanding on Nixon while also challenging the notion that slow speed is intricately connected to victimization, most recent studies on pollution, toxicity, and speed have reinscribed power to the subaltern by invoking the notion of *slow observation*—as Thom Davies proposes in this book—or *slow hope,* as Christof Mauch has put forth. The former describes the witnessing of gradual changes of the local environment and its emancipating powers while the latter encompasses the idea that given humanity's vast power to manipulate our earth's ecosystems in destructive ways, we might also be able to imagine a more beneficial impact.[35] Both approaches offer us productive ways of analyzing how people come to live with sustained environmental brutality.

While speed is crucial as an analytical category, it reduces the time relation between humanity and the rest of nature to one of different timescales and limits our frame of analysis to that of linear time. As Adam illustrates in *Timescapes of Modernity,* there are many more different time models, such as seasonality, rhythmicity, or a radioactive isotope's half-life. The notion of toxic timescapes, as proposed in this book, captures the many different possible ways of relating time and toxicity—that is, between (a) past, present, and future, (b) slow and fast, and (c) linear, rhythmic, and seasonal—while situating these different embodied and lived rhythmicities in space. The different contributions in this book do not cover them all in one example; rather, they each highlight different facets of those toxic space-time relationships. Some of the chapters give theoretical and methodological guidance, others source-based examples.

Toxic Timescapes as a Book

This interdisciplinary volume—edited by two environmental historians—brings together renowned and advancing scholars from the disciplines of history, science and technology studies, human geography, political ecology, and philosophy under the umbrella of the environmental humanities to provide a combination of theoretical, methodological, and case-based explorations of the hazardous intersectionality

of time, space, and body in the twentieth and twenty-first centuries. Contributions acknowledge the overlapping and intersection of multiple human and more-than-human regimes of time and space in stories of contamination and pollution, calling these *toxic timescapes.* Each chapter has a similar framing as we have asked authors to commence their contributions defining their specific toxic timescape and to end with a recommendation for readers of how to explore further.

The volume is divided into four subsections—(1) Conceptualizing the Long Term, (2) Ontologies of Toxic Space, (3) Expanding upon the Toxic Body, and (4) Conceptualizing Toxic Futures—paying tribute to the main different intersectional constellations of the elements of time, space, and body that we see as integral to the concept of toxic timescapes. The case studies by some of our authors lend themselves more readily to a discussion of the rhythmicities of human, more-than-human, and toxicity's time and timing (Ohman Nielsen, Davies, Borowy), while others are more about how the accumulation or dissolution of toxicity in space brings about a discussion of situatedness and containment (Biggs, Antonova, Wright). Yet another set of case studies clusters around the exploration of the toxic body as a site of violence and emotions as well as resilience and resistance (Iengo and Armiero, J. Peterson, Kirchhof, Ferdinand). In the last cluster, notions of futurity and questions of how to continue living on a contaminated planet are key (Parry, M. Peterson, Laboissière). Each of these four subsections is preceded by a short introduction to the theme of the section, including an overview of the individual chapters and their key arguments.

To end, let us return to the stars. Since prehistoric times, humanity has been not only gazing at the sky and its nightly star formations, but imagining itself among them. These visions, mythologies, and imaginaries have received a new quality in the twentieth century. Since the beginning of crewed space flight in 1961, the small but unique subdiscipline of space toxicology has concerned itself with the study of toxic exposure of humans in space, such as inhalation of reactive mineral dust or exposure to radiation more generally. As we humans are directing our yearning increasingly toward other celestial bodies—potential planets B—the small subdiscipline of space toxicology is growing in importance. It provides the promise of safekeeping humanity as we venture toward new, possibly virgin, pristine, and healthy environments with which we might hopefully fare better than with planet Earth.[36] *Toxic Timescapes* wants to provide an opportunity to

return our gaze and our concern back to the one planet that we do have and to inspire inquiries of how we can make sense and come to solutions for—as scholars and concerned citizens—the toxic avalanche that we are facing in our age of the toxic commons.

Notes

1. European Space Agency, NASA, and J. Hester (Arizona State University), "Description of Messier 17, Milky Way Nebula," released April 24, 2003, https://spacetelescope.org/images/heic0305a/.
2. European Space Agency.
3. Nigel Henbest and Heather Couper, *The Guide to the Galaxy* (Cambridge: Cambridge University Press, 1996), 209.
4. An important discussion on containment happened at the 4S Annual Meeting, September 4–7, 2019, in New Orleans, on the theme "Opening Up Containment: Spaces, Trajectories, and Forms of Life."
5. See, for instance, Benjamin Ross and Steven Amter, *The Polluters: The Making of Our Chemically Altered Environment* (New York: Oxford University Press, 2010); Julian Cribb, *Poisoned Planet: How Constant Exposure to Man-Made Chemicals Is Putting Your Life at Risk* (Sydney: Allen & Unwin, 2014).
6. François Jarrige and Thomas le Roux, *The Contamination of the Earth: A History of Pollutions in the Industrial Age,* trans. Janice Egan and Michael Egan (Cambridge, MA: MIT Press, 2021).
7. Michelle Mart, *Pesticides, a Love Story: America's Enduring Embrace of Dangerous Chemicals* (Lawrence: University Press of Kansas, 2015); Frederick Rowe Davis, *Banned: A History of Pesticides and the Science of Toxicology* (New Haven, CT: Yale University Press, 2014). See also Carey Gilliam, *Whitewash: The Story of a Weedkiller, Cancer and the Corruption of Science* (Washington, DC: Island Press, 2017). For an overview of research on pesticides prior to 1962, see José-Ramón Bertomeu-Sánchez, "Introduction. Pesticides: Past and Present," *Journal of History of Science and Technology* 13, no. 1 (2019): 1–27. See also "Chemical Safety: Pesticides," World Health Organization, October 26, 2020, https://www.who.int/topics/pesticides/en/, and "Highly Hazardous Pesticides (HHPs)," UN Environment Programme, accessed June 14, 2022, https://www.unenvironment.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/highly-hazardous-pesticides-hhps.
8. Stacy Alaimo, *Bodily Natures: Science, Environment, and the Material Self* (Bloomington: Indiana University Press, 2010), or Nancy Langston, *Toxic Bodies* (New Haven, CT: Yale University Press, 2011).
9. Jacob Darwin Hamblin, *Arming Mother Nature: The Birth of Catastrophic Environmentalism* (New York: Oxford University Press, 2013); R. Shiloh Krupar, *Hot Spotter's Report: Military Fables of Toxic Waste* (Minneapolis: University of Minnesota Press, 2013).

10. Paul E. Rosenfeld and Lydia G. H. Feng, *Risks of Hazardous Wastes* (Burlington, MA: William Andrew, 2011).
11. Ilenia Iengo and Marco Armiero, chapter 7, this volume.
12. Julian Cribb cited in *SciNews,* "Scientists Categorize Earth as a 'Toxic Planet,'" February 7, 2017, https://phys.org/news/2017-02-scientists-categorize-earth-toxic-planet.html. On the regulation of contaminants, see Ernst Homburg and Elisabeth Vaupel, eds., *Hazardous Chemicals: Agents of Risk and Change, 1800–2000* (New York: Berghahn Books, 2009).
13. Simone Müller, "Toxic Commons: Toxic Global Inequality in the Age of the Anthropocene," *Environmental History* 26, no. 3 (2021): 444–50.
14. For a selection, see David Arnold, *Toxic Histories: Poison and Pollution in Modern India* (Cambridge: Cambridge University Press, 2016); Soraya Boudia and Nathalie Jas, eds., *Powerless Science? Science and Politics in a Toxic World* (New York: Berghahn Books, 2014); Craig E. Colten and Peter N. Skinner, *The Road to Love Canal: Managing Industrial Waste before EPA* (Austin: University of Texas Press, 1996); Pete Daniel, *Toxic Drift: Pesticides and Health in the Post–World War II South* (Baton Rouge: Louisiana State University Press, 2005); David Kinkela, *DDT and the American Century: Global Health, Environmental Politics, and the Pesticide That Changed the World* (Chapel Hill: University of North Carolina Press, 2013); Richard S. Newman, *Love Canal: A Toxic History from Colonial Times to the Present* (New York: Oxford University Press, 2015); James C. Whorton, *The Arsenic Century: How Victorian Britain Was Poisoned at Home, Work, and Play* (Oxford: Oxford University Press, 2011). Much neglected so far is the Scandinavian perspective despite Sweden being such an important player in the internationalization of modern environmentalism. See David Larsson Heidenblad, *Den gröna vändningen* (Lund: Nordic Academic Press, 2021), forthcoming in English as *The Environmental Turn in Postwar Sweden: A New History of Knowledge* (Manchester: Manchester University Press, 2021).
15. Mart, *Pesticides, a Love Story;* Frank Uekotter, *The Age of Smoke: Environmental Policy in Germany and the United States, 1880–1970* (Pittsburgh, PA: University of Pittsburgh Press, 2009); Jacob D. Hamblin, *Poison in the Well: Radioactive Waste in the Oceans at the Dawn of the Nuclear Age* (New Brunswick, NJ: Rutgers University Press, 2008).
16. D. N. Pellow, *Resisting Global Toxics: Transnational Movements for Environmental Justice* (Cambridge, MA: MIT Press, 2007); Julie Sze, *Noxious New York: The Racial Politics of Urban Health and Environmental Justice* (Cambridge, MA: MIT Press, 2010); Oluwafemi Alexander Lapado, "The Contribution of Cartoonists to Environmental Debates in Nigeria: The Koko Waste Dumping Incident," in "Eco-Images: Historical Views and Political Strategies," *RCC Perspectives* no. 1 (2013): 61–71.
17. A great contribution to thinking more generally about the interlocking of human and more-than-human temporalities during the Anthropocene is Bethany Wiggin, Carolyn Fornoff, and Patricia Eunji Kim, eds.,

Timescales: Thinking across Ecological Temporalities (Minneapolis: University of Minnesota Press, 2020).

18. A classic example is the "donation" of obsolete pesticides to African nations from the West, which are now corroding in their containers. Andreas Bernstorff and Kevin Stairs, *POPs in Africa: Hazardous Waste Trade 1980–2000, Obsolete Pesticide Stockpile, A Greenpeace Inventory,* prepared for the fifth intergovernmental negotiating committee for an international legally binding instrument for implementing international action on certain persistent organic pollutants (POPs/NC5), Johannesburg, South Africa, December 4–9, 2000 (Amsterdam: Stichting Greenpeace Council, 2000).
19. Anna Storm, *Hope and Rust: Reinterpreting the Industrial Place in the Late 20th Century* (Stockholm: Royal Institute of Technology, 2008).
20. By the 1990s, researchers had noticed that it was not only wildlife species that were showing difficulties with reproductive health but also increasing numbers of people. Since 1970, boys in the United States have become increasingly likely to develop severe hypospadias, a birth defect of the penis. Testicular cancer has increased in many industrialized countries, such as Denmark, where it has more than tripled since World War II. Men in many industrial nations are showing increases in prostate cancer; a 1999 review found that men in the United States in 1994 had a much greater risk of being diagnosed with prostate cancer than their fathers had. Langston, *Toxic Bodies,* 4.
21. Jesse King and Cecilia Chou, "Agent Orange Birth Defects," *The Embryo Project Encyclopedia,* March 7, 2017, https://embryo.asu.edu/pages/agent-orange-birth-defects; P. H. Schuck, *Agent Orange on Trial: Mass Toxic Disasters in the Courts* (Cambridge, MA: Belknap, 1987).
22. Simone M. Müller, "Hidden Externalities: The Globalization of Hazardous Waste," *Business History Review* 93, no. 1 (2019): 51–74.
23. Jo Guldi, "What Is the Spatial Turn?" Scholars' Lab, University of Virginia, accessed October 26, 2018, http://spatial.scholarslab.org/spatial-turn/.
24. Guldi.
25. Doreen Massey, *Space, Place, and Gender* (Minneapolis: University of Minnesota Press, 1994); David Harvey, *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change* (Cambridge, MA: Blackwell, 1990).
26. Roland Wenzlhuemer, "Globalization, Communication and the Concept of Space in Global History," *Historical Social Research* 35 (2010): 19–47.
27. This has been critiqued already by Walter Benjamin. See Walter Benjamin, "Geschichtsphilosophische Thesen," in *Zur Kritik der Gewalt und andere Aufsätze* (Frankfurt am Main: Suhrkamp, 1978), 78–94.
28. Fernand Braudel, "Geschichte und Sozialwissenschaften: Die longue durée," in *Schrift und Materie der Geschichte: Vorschläge zur systematischen*

Aneignung historischer Prozesse, ed. Claudia Honegger (Frankfurt am Main: Suhrkamp, 1987), 47–85; Fernand Braudel, *Das Mittelmeer und die mediterrane Welt in der Epoche Philipps II* (Frankfurt am Main: Suhrkamp, 1994); Reinhart Koselleck, "Erfahrungsraum und Erwartungshorizont. Zwei historische Kategorien," in *Vergangene Zukunft: Zur Semantik geschichtlicher Zeiten* (Frankfurt am Main: Suhrkamp, 1989), 349–75.

29. Vanessa Ogle, *The Global Transformation of Time* (Cambridge, MA: Harvard University Press, 2015); Sebastian Conrad, "'Nothing Is the Way It Should Be': Global Transformations of the Time Regime in the Nineteenth Century," *Modern Intellectual History* 15 (2018): 821–48.
30. Niklas Luhmann, "Temporalisierung von Komplexität. Zur Semantik neuzeitlicher Zeitbegriffe," in *Gesellschaftsstruktur und Semantik: Studien zur Wissenssoziologie der modernen Gesellschaft* (Frankfurt am Main: Suhrkamp, 1980), 235–300; Niklas Luhmann, "Die Beschreibung der Zukunft," in *Beobachtungen der Moderne* (Opladen: Westdeutscher Verlag, 1992), 129–47; Niklas Luhmann, "The Future Cannot Begin: Temporal Structures in Modern Society," *Social Research* 43, no. 1 (1976): 130–52.
31. Barbara Adam, *Timescapes of Modernity: The Environment and Invisible Hazards* (London: Routledge, 1998).
32. See Mart, *Pesticides, a Love Story;* Daniel, *Toxic Drift;* May-Brith Ohman Nielsen and Anne Mette Seines, "Poison to the Beasts: Changing Poisons and Poisoning Practices in Campaigns to Kill Norwegian Birds and Mammals, 1845–1967," *Environment and History* 25, no. 3 (2018): 321–64.
33. Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2011).
34. See, for instance, the six contributions in the special issue "Disasters Fast and Slow," edited by Fiona Williamson and Christ Courtney, *International Review of Environmental History* 4, no. 2 (2018): 2; similarly, see Scott Frickel, "Disasters Fast and Slow: The View from Environmental Studies" (paper presented at the 129th Annual Meeting of the American Historical Association, New York, NY, January 2, 2015).
35. Thom Davies, "Toxic Space and Time: Slow Violence, Necropolitics, and Petrochemical Pollution," *Annals of the American Association of Geographers* 108, no. 6 (2018): 1537–53; Christof Mauch, "Slow Hope: Rethinking Ecologies of Crisis and Fear," *RCC Perspectives: Transformations in Environment and Society* no. 1 (2019).
36. Noreen Khan-Mayberry, John T. James, Rochelle Tyl, and Chiu-wing Lam, "Space Toxicology: Protecting Human Health during Space Operations," *International Journal of Toxicology* 30, no. 1 (2011): 3–18, https://doi.org/10.1177%2F1091581810386389; W. J. Rippstein Jr., "The Role of Toxicology in the Apollo Space Program," in *Biomedical Results of Apollo,* ed. Richard S. Johnston, Lawrence F. Dietlein, and Charles A. Berry (Washington, DC: National Aeronautics and Space Administration, 1975), 151–59.