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5 Toxic Commons and the Politics of Ambivalence

Re-imagining Toxic Legacy Sites

Simone M. Müller and Angeliki Balayannis

Introduction[1]

The grazing bison at the Rocky Mountain Arsenal National Wildlife Refuge, with the skyline of Denver as their backdrop, were an iconic sight, marrying multiple strands of human–environment relationships throughout US history. Covering more than half a page in the TRAVEL section of the *Roanoke Times* and other smaller newspapers that had bought the Associated Press's package, the image was placed to evoke readers' desire to experience nature the American way.[2] Only a ten-minute drive from downtown Denver, visitors to the refuge could "step into nature and see the native wildlife."[3] This included a potential meet and greet with the last descendants of a species that a century-and-a-half earlier had been hunted by white American colonizers almost to extinction. As part of a national restoration and rewilding program, a small bison herd was moved into Rocky Mountain Arsenal in 2007 (see Figure 5.1).[4] On its website, the park advertises different routes for different time schedules, among them a one-hour, 11-mile self-guided drive compatible with a specially recorded podcast, i.e., low-motion access to "native wildlife" while remaining in the heart of Denver.[5] Like the bison, national parks are iconic institutions in the United States, signifying the country's long-standing commitment to the protection of nature on top of a heated and fundamentally colonial debate on what counts as "wilderness."[6] National parks have been forged through a complicated, one could say *ambivalent*, relationship between nature and culture, or rather between notions of roadlessness and the sacrality of this wilderness, on the one hand, and an expanding automobility of and accessibility to nature, on the other.[7]

Yet, even in this context of cultivated wilderness, Rocky Mountain Arsenal is unique among US wildlife refuges. The 15,000-acre site is a former military installation, making the ambivalence even more pronounced. In the 1940s and 1950s, it hosted a chemical weapons factory for the US Army and then was leased to companies producing commercial pesticides. Before it became a wildlife refuge, the area was part of the US superfund program dedicated to cleaning up and remediating the country's most contaminated sites.[8] As a prior location for military activities, a veil of secrecy still lies over much that had been going on at Rocky Mountain Arsenal. Nonetheless, it is undisputed that some of the wildlife

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Figure 5.1 Rocky Mountain Arsenal, four bison with a Denver skyline.

Source: © Elisa Dahlberg/US Fish and Wildlife Service, October 13, 2016.

refuge is still heavily contaminated.[9] To this day, the U.S. Fish and Wildlife Service fences off no-go areas in the park and prohibits swimming, wading, and bathing in all refuge waters, alongside the use of boats, canoes, kayaks, float tubes, paddle boards, and other flotation devices.[10] Some of the "pristine" nature is too toxic to behold.

Toxic legacy sites such as Rocky Mountain Arsenal are a systemic—yet often sidelined—issue in the processes that this book, "Ecological Ambivalence, Complexity, and Change: Perspectives from the Environmental Humanities," calls the "ecological transformation of society." Toxic legacy sites, both figuratively and physically, illustrate how societies across the world are confronted with millions of metric tons of toxic chemicals, both as synthetic and natural materials, that have over centuries been released into our air, water, and soil as part of industrial, agricultural, and military activities. They represent how the past lingers in the present and can harm (generations of) human and more-than-human bodies in substantive and yet unequal ways. For a long time, they have primarily figured as an engineering issue aimed at the restitution of "pristine" nature with an away-place, an ultimate sink, where extracted contaminated soils could be taken to vanish.[11] Nonetheless, as toxic materials can never disappear, they can only be "transformed, transmuted, combusted, combined or any other manner of material change."[12] How, then, do we deal with what remains?

It is the responsibility of the Environmental Humanities to pose questions (and to find answers) relating to how to live with a toxic past that remains in the present.

Recently, researchers, activists, and artists have started to shift their attention from future-oriented clean-up and remediation processes to discourses and practices of how people form (and have formed) relationships with already existing toxic legacies in the present. Under the framing of toxic heritage, a small but growing number of scholars and artists are working on the intersection of how (and if) sites of environmental harm are treated as "heritage," and how this heritage accounts for environmental harm.[13] Artistic-research interventions, meanwhile, seek to theorize a deepened understanding of a planet experiencing multiple crises while reaching out to a larger, non-academic public about toxicity, coloniality, and unequal burdens.[14]

Joining forces of a historian and a human geographer and approaches from environmental history with feminist STS, our contribution forges new conceptual pathways in this burgeoning field. Pivoting from critiques of chemical exposures and toxic entanglements toward interventions and experiments that can confront these legacies,[15] this contribution introduces the concept of *Toxic Commons* to respond to questions relating to how to work with complex and unruly legacies such as Rocky Mountain Arsenal. Toxic Commons is both a heuristic category for historicizing the processes of the increasing contamination of our air, water, and soil and an analytical category, a relational epistemology, that challenges notions of clean-up and containment and seeks to invoke commons literature to inspire a new ethics of care for the toxic. Ultimately, Toxic Commons—a form of "negative" commons—invites a politics of ambivalence that seeks to respond to a past that lingers in the present and to a state of contamination that divides as much as binds us.[16]

Studying Toxic Commons beyond Remediation and Clean-up

Toxic legacy sites are notoriously difficult to study. Scholars in the social sciences and humanities have long demonstrated the legal, material, and political barriers to this research[17], consequently making it challenging to recognize links across sites and their shared processes and institutions. For example, different national legislations make it difficult for researchers to engage holistically and across nation states with toxic heritage sites—an issue that often commences with geolocating. While in the United States, in Austria, or in Switzerland, the toxic legacy cadasters help identify specific sites, the German *Atlastenkataster* obscures exact location markers. Prioritizing data security, particularly if legacy sites are still classified as suspicious sites, German agencies only give away the village or town and the kind of usage leading to contamination.[18] Often overgrown with grasses, old waste deposits, for instance, are difficult to see without technoscientific interventions. Old industrial sites, in turn, tend to be fenced off, giving the air of inaccessibility and thus at least the illusion of toxic containment—an illusion that is often nourished from proud narratives of industrial heritage.[19]

Another issue involves assigning responsibility for sites of contamination and damage and thereby establishing, if not a juridical, then a historical lineage to help

understand the site as a legacy formed through materiality as well as relations. Polluters are often states that are no longer in existence or companies that have dissolved and abandoned or lost their archives. It is difficult to individualize responsibility to consumers as pollution emerges at sites of manufacturing or disposal, and causality is often impossible to determine because it is too expensive within existing governance mechanisms, such as a lack of "return to sender" programs.[20] The expansive temporalities and spatialities of these sites ultimately demonstrate the limits of the law, notions of responsibility, and regulatory mechanisms. As the chapter will detail further below, toxic legacy sites exceed political and even human timescales, with geographies that are unruly, thus transgressing boundaries and borders.[21] The way they have been archived and cared for in the past, finally, makes it difficult to develop an organigram of the relationships toxic legacy sites entertain with various actors and institutions.

In response, scholarship has often turned elsewhere, with "elsewhere" in this regard meaning the attempt to rectify the past by looking into the future. Even before the UN acclaimed its "Triple Crisis" of 2020, pairing contamination with climate change and biodiversity loss, research on planetary health, remediation, and clean-up vastly expanded with studies seeking how to restore a pristine planet.[22] Dominant forms of mainstream (and often white) environmentalism, meanwhile, have focused on calls to stop pollution at its source. The new global treaty to address plastic waste "from source to sink" is the clearest example of this mode of environmental politics.[23] Calls to halt the production of new, *future* pollution—and to shift to "circular" or "zero waste" economies—are of course crucial for addressing extraction.[24] As we like to broaden the attention from the chemicals and policies of clean-up to practices and discourses resonating with today's ubiquity of toxic contamination and the commonality of exposure, we prefer to speak of and work with a present that is shaped and informed by a past that lingers on in polluted soil, rivers, buildings, bodies, and memories. We do so by introducing the Toxic Commons.[25]

Toxic Commons is both a heuristic category, as in the age of the Toxic Commons, for historicizing the process of the increasing contamination of our common-pool resources—our air, water, and soil—and with it an increasing, albeit unequal, commonality of toxic exposure since at least industrialization. It is also an analytical category, a relational epistemology, that seeks to reconcile the situated with the planetary in the context of pollution as a global problem, and with this some of the ambivalences of ecological transformation. As this chapter will illustrate, Toxic Commons challenges notions of containment and invokes commons research to also include negative externalities. Furthermore, through them, we seek to enable ways of understanding, living with, and ultimately caring for toxic legacies, thereby responding to a lack of adequate epistemological, ethical, and technological tools to intervene at toxic sites. Moreover, it invites researchers to move beyond a recognition of being-in-common to investigate discourses and participate in practices of commoning, i.e., sharing knowledge and decision-making about toxic sites and their legacies in ways that go beyond the individual or the singular community.

Introducing the Age of the Toxic Commons

Toxic Commons, that is, heuristically speaking, contaminated soil, air, or water, have built up over the course of centuries. As historians can trace from archival sources, and geologists, earth scientists, and toxicologists from soil or rock samples, some of the earliest contaminated sediments go back to mineral mining across Asia, the Americas, and Europe. Gold, iron, copper, and tin were mined, smelted, and worked into ornaments, utensils, and weapons in Southeast Asia long before the Common Era, nourishing active trade between China and the larger Southeast Asian region that expanded rapidly. By the 17th century, the Chinese also exploited mineral resources in what is today Burmese and Lao territory before the British took over the exploitation of these resources and their trade. In the German Ruhr valley, in the Upper Harz, and similarly in Lower Hungary, miners have extracted coal for over five centuries, not only sinking the land, in some cases by up to 60 feet, but also blowing millions of tons of coal dust into the air. In the Americas, indigenous groups mined for gold in the Caribbean, Mexico, and the Andes, while Spanish mining efforts in one of the largest silver deposits at the Cerro Rico de Potosí, today Bolivia, commenced as early as 1545, followed by other mining endeavors in what are today Peru, Brazil, Colombia, and Chile. In all cases, mining activities have resulted in a historical legacy of heavy metal contamination, particularly antimony and arsenic in the surrounding areas.[26]

With industrial capitalism evolving first in Europe and then the rest of the world from the 18th century onward, pollution patterns, their scale, and how they have been breached and understood fundamentally changed. On the back of a shift in energy regimes from solar to fossil fuels, new technologies, ranging from the steam engine to generators and the steam turbine, unleashed industrial power in unprecedented ways. New and faster mobility and communication patterns in turn nurtured the built-up of a global market structure catering to appetites for ever more diverse products, all of which resulted in almost endless pollution and waste streams, with rivers, lakes, and creeks running black and air suffocatingly orange, as vividly captured by Claude Monet and other painters of the London Smog or the Black Country, an industrial region in the center of England.[27] The 20th century saw the emergence of toxic legacy sites on an even grander scale, due to industrialization and agriculture's growing intensity, their globalization, and an array of new contaminants. Production processes that relied increasingly on synthetic chemicals while being, at least until the 1970s, vastly unregulated in terms of discards and disposal, a vastly expanding and globalizing consumer culture, and a high-production-yield agriculture based on an excessive use of pesticides, all fed into vast waste and pollution streams. Scientists and environmentalists, ranging from Rachel Carson to Barry Commoner, alerted us to topics including pesticides and waste incineration.[28] Additionally, the use of chemical warfare in the First World War, as well as on a grand scale in Vietnam and Iraq, and the continued extraction of energy resources and primarily fossil fuels have greatly added to the creation of a permanently polluted planet.[29]

The tonnage, ubiquity, and longevity of toxic chemicals within, but also beyond, toxic legacy sites have led some scholars to describe this planetary condition as a "new age of toxicity" or a "ubiquitous condition of chemically altered living-being."[30] While this classification has placed an increasing spotlight on contamination as a key issue of concern, it also symbolizes the growing obfuscation of our understanding of "the toxic." In the last two decades at least, the boundaries of what constitutes a pollutant have become more porous with, so far, poorly understood cumulative effects due to the longevity of chemicals' molecular makeup and the emergence of a cocktail of different toxicants. While yesterday's persistent organic pollutants, such as DDT, are still present, hundreds of thousands of new chemicals continue to be marketed.[31] Today, there are over 350,000 synthetic human-made chemicals in the world that have accumulated over decades, if not centuries.[32]

Additionally, as toxicants perceptible to the senses, such as fumes and blackened water, no longer constitute the greatest danger from toxic legacy sites, attention has shifted to bodies that are saturated with toxic substances.[33] There is also growing evidence that many synthetic chemicals can cause serious health problems, including cancer, neurological problems, and endocrine disruption. Since the 1990s, and as highlighted by Theo Colborn's 1996 publication *Our Stolen Future*, endocrine-disrupting chemicals, i.e., compound chemical agents that can alter a body's hormonal system, have come to the fore, invisibilizing and complicating modes of exposure.[34] With endocrine-disrupting chemicals, public health specialists have had to extend their metric for ascertaining harm switching from dose to moments of exposure and the possibility of multiple exposures, also called cocktail effect.[35] Toxic Commons have arrived on the small scale of the human and more-than-human body, as well as the grand scale of the planet. A study warns that the Earth's threshold for chemical pollution has been breached, meaning that its impacts on systems such as nitrogen cycling or the spread of invasive species are beyond our capacity to understand, let alone control.[36]

In this history of accumulating contamination with overlapping modes of exposure, we are cognizant that the creation of a permanently polluted planet is a product of racial capitalism. The term "environmental racism" stands at the beginning of the environmental justice movement, recognizing how minoritized groups are disproportionately affected by toxic pollution.[37] Unequal exchanges and geographically expanding externalization processes are also an integral part of global pollution patterns, thereby constituting one of the downsides of modern environmentalism, in that its nationalistic approach has created an environmental governance framework through which usually white elites of the Global North live well at the cost of others far distant, where less strict rules and regulations apply.[38] Since the 1980s, the global trade in hazardous waste material has benefitted from such differences, making the export of toxicants from North to South an economic opportunity.[39] Since 2007, the NGO Pure Earth has assembled lists of the world's most contaminated sites through its Toxic Site Identification Program (TSIP), with Sub-Saharan Africa and South and Southeast Asia consistently ranking first in this regard. Alongside the relocation of hazardous waste from North to South, risk and the outsourcing of dirty production are also—intentionally—unevenly distributed.[40]

Toxic Commons as Unruly and Uncontainable

Thinking with Toxic Commons as an analytical category involves a fundamental shift away from binary conceptualizations of contamination and cleaning up, questioning notions of territoriality and containment. The concept asks scholars to challenge the intricate linkages between environmental protection and national sovereignty as enshrined by the United Nations system after the Second World War and reemphasized by the institutionalization of modern environmental governance since the 1970s.[41] Instead, Toxic Commons suggests embracing the ambivalence that comes with recognizing contamination, particularly on a planetary scale, as unruly and often uncontainable. The point we are making also begs for the recognition of a historical trajectory based on the understanding of a planetary materialism that has thus far received little attention in the established narrative of modern environmentalism, namely that the long-range atmospheric transport of pollutants, as in acid rain or radionuclear clouds, or similarly long-range transports in water, as in the Great Pacific Garbage Patch, have played a fundamental role in the creation of the Toxic Commons.

Scientists and politicians commenced in the early 1980s to work around phenomena that they termed "problems without passports," almost all of which were linked to issues of contamination.[42] A first step in that direction was the completion of a shift toward a public understanding of planetary circularity, not only in global trade but also in atmospheric terms. Scientists were puzzled as they continued to measure the same pesticides banned in the U.S. a decade earlier in the Great Lakes and other bodies of water.[43] In Europe, meanwhile, foresters, politicians, and society discussed the issue of *Waldsterben*, eventually connecting it to acid rain, i.e., the precipitation of sulfuric or nitric acid, with suspected sources located hundreds of kilometers away.[44] Coming through the air, nitric or sulfuric acids originating in the United Kingdom, for instance, traveled in global circulations of particulate clouds before rain washed them into different landscapes in Central and Northern Europe. While the topic of long-range atmospheric transport had entered a scientific, niche discourse with a particular focus on mercury, the *Waldsterben* discourse boomeranged the issue as a top international priority. By 1983, the topic had gained such political momentum that it led to the passage of the UN Convention on Long-Range Transboundary Air Pollution.[45]

Not only atmospheric circularity but also trade patterns made the commonality of contamination a felt reality. For instance, for the first time, in 1981, environmental activists cited the failures of national governance for the containment of toxic chemicals in the context of a free-market-driven global economy.[46] Pesticides, such as DDT, chlordane, or heptachlor, which the U.S. Environmental Protection Agency had taken off the market because they were seen as carcinogenic and capable of endangering humans, wildlife, and the environment, continued to be exported to other parts of the world where they were still legal.[47] As an unintended consequence, they also returned to the U.S. through the global foodways of tropical fruits, coffee, tea, meat, or corn. In 1986, the U.S. General Accounting Office reported that the U.S. Food and Drug Administration (FDA) had found substantial

pesticide residues in a number of commodities in the three years prior.[48] In an 1988 case, for example, chlordane levels in beef imported from Honduras were eight times those allowed in the United States.[49] By the end of the 1980s, this "Circle of Poison" also led American legislators to pass a hapless amendment of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[50]

The reactor catastrophe at Chernobyl, the industrial accident at Bhopal, and the extremities of the Ozone Hole, all neatly happening in close proximity to each other, next emphasized how fervently, violently, and completely harmful substances disregarded logics of containment and easily transgressed political, social, and technological boundaries set up for their control. In 1986, people around the world fearfully watched the catastrophe of nuclear meltdown stretching itself easily far beyond what was then the Soviet Union.[51] In 1984, the Indian city of Bhopal provided a blueprint for an industrial accident when a silent and invisible toxicant indiscriminately killed children and grandparents, women and men, blue and white collar workers, simply because they were within a certain radius of the explosion.[52] Witnessing the rapid thinning of the planet's protective shield, the ozone layer, finally and vividly illustrated the global dimension of borderless chemical threats.[53]

In response to the recognition of these processes, public and scientific international discourses grew from the 1980s onward around the transboundary nature of environmental catastrophe that also informs, albeit partially, our conceptualization of Toxic Commons. Published shortly after the Chernobyl accident, Ulrich Beck's *Risk Society*, later followed by *Ecological Politics in an Age of Risks*, appeared to capture the mood of the time perfectly.[54] Beck saw modernity enter a new phase under the sign of technologically produced risks, in which it was now less about the distribution of the wealth produced and more about the distribution of the risks. This, in turn, led to a completely new social constellation: "Necessity is hierarchical, smog is democratic," Beck argued.[55] His thesis of a democratization of pollution has been heavily contested based on the vast differences in people's opportunities to mitigate effects from exposure, the impoverishment of entire city districts, or the existence of suburban retreat areas.[56] Yet, his point on the leveling effects of an increasingly ubiquitously polluted planet still rings true, as does the underlying realization that in the early 21st century, there are next to no pristine, clean environments that can be neatly zoned off from a contaminated majority world.

Additionally, other conceptual approaches to apprehending the complexity and reach of pollution as a global problem have proliferated in the last few decades, first highlighted by the UN's 1987 landmark publication *Our Common Future*.[57] Introducing the concepts of sustainable development and intergenerational justice, the report extended frameworks of governance, remediation, and responsibility from the past and the present into the future.[58] Around the same time, activist movements forged the term and notion of global environmental justice as a key political response to draw links across seemingly disconnected situations and to highlight the transboundary violence of capitalism and colonialism.[59] The global waste trade and the unequal distribution of hazards connected to it became one of global activists' key issues in the late 1980s, with the United Nations' Basel

Convention on the Transboundary Movement of Hazardous Wastes and Their Disposal as one of the first international governance frameworks to work around environmental justice.[60]

In the last decade, the Anthropocene has been one of the most influential reconfigurations, with geoscientists re-thinking humanity's ecological impact and its more-than-human entanglements in geologic time—an epochal shift. Here, the human is imagined as a species with the potential to fundamentally affect planetary processes, including biospheric, atmospheric, and hydrospheric disruptions.[61] More recently, the health impacts of the Anthropocene have been increasingly approached through an interdisciplinary "planetary health" lens that grew out of "global health" initiatives emerging in the 1990s, cutting across the disconnected logics of public, environmental, and global health.[62]

The social sciences and humanities have responded to the Anthropocene with forceful critiques of thinking at the scale of the planetary, adding a number of different -ocenes as alternatives.[63] They critique the continuation of centering the human; erasing the unevenness and "patchiness" of global environmental problems; and insufficiently targeting capitalism and colonialism as drivers of environmental damage.[64] In Chernobyl and Bhopal, the effects of pollution from these industrial accidents have unfolded along the lines of class, caste, race, and gender—and continue to do so in ways that are institutional and embodied. In the context of the ozone hole, particular regions of the world and particular societal groups from within these world regions were less able to escape potential harm.[65] To return to Michelle Murphy, toxicity is an ambivalent condition; it divides as much as binds us.[66]

Invoking the Negative Commons

Thinking with Toxic Commons as an analytical category involves revisiting the commons and unlocking its potential for an ethics of care. Rather than Ulrich Beck or the Anthropocene, we find in economist Elinor Ostrom a productive source with whom to think when it comes to toxic legacy sites, thereby inspiring the concept of Toxic Commons. Commons-based research is flourishing in the environmental social sciences.[67] Thinking with commons—that is, jointly owned resources—and through commoning practices—that is, self-organized and needs-oriented joint production, administration, or use of these resources—seems to open up a "new paradigm that embodies its own logic patterns of behavior, functioning as a different kind of operating system for society."[68] Commons scholarship sees the commons as potential new models for societies' organization and (ecological) transformation in opposition to a capitalist world organized around profit-oriented entrepreneurs and the nation state, concepts of growth and private property, thus taking inspiration from scholars like Naomi Klein or activists like David Bollier who see the commons, in contrast, as a "new paradigm," a "coalition of coalitions," or "a silent revolution."[69]

Practices of commoning are key to this new paradigm, i.e., acts of (multi-species) relations "made under the expectation that we will take care of one another" (and

the planet) and with "a shared understanding that some things belong to all of us."[70] Nevertheless, the literature remains fixed on the commons as a positive. In our work, we extend Ostrom's approach of communal governance and responsibility to negative externalities as commons. As neoclassic models of economy have seen nature and its resources as being free of cost, the pollution of common-pool resources, such as air, water, and soil, has become a negative externality outside of economic modeling, which, in turn, presupposes private property.[71] In Toxic Commons, externalities are reintroduced, but not as private property or as an entity that itself holds private property but as a universal good that belongs to all of us.[72] The question we seek to evoke through Toxic Commons is what happens if we apply Hugo Grotius' idea of Mare Liberum to toxic legacy sites, if these, too, become a shared heritage of humankind instead of a *res nullius*?[73] Toxic legacy sites, we argue, belong to all of us, too.

We argue that this expansion of commons to Toxic Commons challenges what commoning means, as well as who is involved and on what scale. The investigation of toxic commoning as shared practices of governance and responsibility for toxic legacies is about neither flattening power relations nor reducing actions to the community level, leaving affected communities to sort things out on their own. Toxic legacies, i.e., contaminated and damaged sites and relations, transgress sectoral and geographical boundaries, necessitating the intervention of actors beyond the affected community, which subsequently calls for a multi-scalar and often, given the nature of multinational entrepreneurship, international stewardship for these sites and affected communities.

The history of the internalization of pollution is one floored with failures. And yet, our endeavor is not to be read as a renewal of Hardin's "Tragedy of the Commons."[74] Ostrom's work has effectively answered popular theories around Hardin's essay, which postulated that private property is the only way to protect finite resources from depletion. Additionally, we argue, notions of individual ownership of toxic legacies, reducing responsibility to the community level, follow the same flawed, colonial, and racist logics.[75] Rather, as Ostrom illustrates, successful collective forms of governance rely on clear rules, frameworks, and common institutions that involve everyone concerned and affected.[76]

Conclusion

What is described herein is in many ways a politics of ambivalence. Bringing commoning and toxicity together enables a form of pragmatism and experimental ethos that moves beyond "purity" politics that demand clean slates.[77] This is not only a call to "make do" on a damaged planet—following a long line of scholars in the environmental humanities[78]—but also a recognition that disposal, remediation, or "clean-up" are always, partially, *ambivalent*. The damage cannot be undone. Which brings us to the question: if environments and bodies remain forever irrevocably contaminated, what constitutes a "good" response? Toxic Commons takes this question as its starting point. It is an analytical tool to foreground material processes of local persistence and planetary diffusion that make exposure to

contamination an increasingly common and communal experience. Furthermore, it facilitates research that engages with the failures of national ecological containment and the limits to safeguarding national environments and citizens in a highly mobile world of global markets. Ultimately, though, it serves as a counter-narrative to established histories that legitimize the state as a primary actor and a respondent of intervention and ecological transformation.[79]

Rocky Mountain Arsenal is a vivid example not only for the ambivalences of ecological transformation but also for the challenges involved in transforming toxic legacy sites into a community asset and effort, what we would call a Toxic Commons. It is a transformation, however, that requires more than just the clean-up: "More than in a physical sense," such as a kind of ecological transformation, "requires a shift in mindset and acceptance by the community" concluded law professor Rachael E. Salcido after closely following transformation processes at Rocky Mountain Arsenal.[80] In 1992, US Congress passed the Rocky Mountain Arsenal National Wildlife Refuge Act to make space for transforming the military site into a wildlife refuge. The Act restricted the sale of part of the land still containing waste and remediation facilities and defined that the vast acreage was to be managed by the Federal Fish and Wildlife Service. In 2004 and 2006, 4,930 and 7,266 acres of land, respectively, were transferred from the Army to the Department of Interior, to be managed by the Federal Fish and Wildlife Service. The bison returned to Rocky Mountain Arsenal in 2007. Meanwhile, the State of Colorado and the US Army were locked in a court battle over whether the former could assert authority. The situation worsened when, in 2001, an unexploded M-74 munition was found and the Army and its contractors decided to put it back where it was found and to deceive the Colorado Department of Public Health and Environment regarding their discovery.

At first site, Rocky Mountain Arsenal National Wildlife Refuge may appear as a Toxic Commons failure. During the years of the initial clean-up, as Salcido relates, the Denver community had little opportunity to contribute to or engage in restorative acts because of the dangers of pollution at the site and a lack of trust in ensuring the safety of entrants. Moreover, at times, the community has been "enraged by the lack of transparency and outright deception perpetrated by those responsible for restoration, and frustrated by marketing of the refuge which downplayed the risks and trade-offs made in the remedy selected for the site."[81] Overall, the ecological transformation of the Rocky Mountain Arsenal has been marked by a "community that has been alternatively deceived, shut out of decision-making and had its concerns marginalized," and yet it remains a community that has experienced "skepticism, fear, and *hope for the future* all at once."[82] Today, the Denver community is living with Rocky Mountain Arsenal as its neighbor. Is this enough of a success? We think so, at least for now.

Notes

1 On citation and interdisciplinarity: an endnote on endnotes. When writing this contribution, citation style became a way of thinking about what it means to interdisciplinary

research. Disciplinary differences between history and geography—for us, this is effectively between the social sciences and humanities—materialized in citational practice. Angeliki has no experience of working with (or learning how to use) endnotes, whereas for Simone, they are central to historical research practice. This difference is more than a matter of style. It raises questions around what matters in research, or even what *constitutes* it. For Angeliki, in-text citation quickly points to specific concepts and approaches; a conceptual shorthand. It also directly recognizes the work of others in her text—and this co-presence of author and citation is, for Angeliki, about citational politics. For Simone, the endnote, and even more so the footnote is a pivotal space for recognizing the specificity of sources, including often very lengthy primary source citations and their interpretation. In history, interpretation outranks frameworks, as the latter, particularly if they are rigorously defined, often do not stand the test of "change over time." In-text citations, for Simone, can be disruptive for the reader and get in the way of storytelling, which has become a key mode of research within the environmental humanities, and is how we arrived at our decision to endnote. Learning from Max Liboiron's reimagination of the capacities and ethics of footnotes and endnotes, we also approach this space as an opportunity to discuss our interdisciplinary practice.

2 Donny Bryson (Associated Press), "Mile-high Haven," *Roanoke Times*, November 4, 2012.

3 U.S. Fish and Wildlife Service, "*Rocky Mountain Arsenal National Wildlife Refuge*," last accessed December 12, 2023, www.fws.gov/refuge/rocky-mountain-arsenal; Andrew C. Isenberg, *The Destruction of the Bison. An Environmental History, 1750–1920* (Cambridge: Cambridge University Press, 2000).

4 Rachael E. Salcido, "The Rocky Mountain Arsenal National Wildlife Refuge. On a Rocky Road to Creating a Community Asset," *John Marshall Law Review* 47, no. 4 (2018): 1399–1430, here 1407.

5 U.S. Fish and Wildlife Service, "*Rocky Mountain Arsenal National Wildlife Refuge*."

6 William Cronon, "The Trouble with Wilderness, or getting back to the wrong nature," in *Uncommon Ground: Rethinking the Human Place in Nature*, ed. William Cronon (New York: Norton, 1996), 69–90.

7 Paul S. Sutter, *Driven Wild, How the Fight Against Automobiles Launched the Modern Wilderness Movement* (Seattle: University of Washington Press, 2005).

8 On the US Superfund Program, see Joel A. Mintz, *Enforcement at the EPA: High Stakes and Hard Choices,* Revised Edition (Austin: University of Texas Press, 2012).

9 Salcido, *The Rocky Mountain Arsenal*, 1400.

10 U.S. Fish and Wildlife Service, "*Rocky Mountain Arsenal National Wildlife Refuge*".

11 Joel Tarr, *The Search for the Ultimate Sink: Urban Pollution in Historical Perspective* (Ohio: University of Akron Press, 1996).

12 Angeliki Balayannis, "Toxic Sights: The Spectacle of Hazardous Waste Removal," *Environment and Planning D EPD: Society and Space* 38, no. 4 (2020): 772–790, here 772.

13 For an example from the humanities, see: Elizabeth Kryder-Reid and Sarah May (eds.), *Toxic Heritage Legacies, Futures, and Environmental Injustice* (London: Routledge, 2024); Caroline Ektander and Jonas Stuck, "Redistribute Toxicity," *Environmental Humanities* 15, no. 3 (2023): 104–118; Gustav Wollentz et al., "Toxic Heritage. Uncertain and Unsafe," in *Heritage Futures. Comparative Approaches to Natural and Cultural Heritage Practises*, eds. Harrison Rodney et al. (London: UCL Press, 2020), 294–312.

14 In 2018, Antonia Alampi, Ayushi Dhawan, Caroline Ektander, Maximilian Feichtner, Simone M. Müller, and Jonas Stuck founded the artist-research network *Toxic Commons*

realizing two joint exhibitions, e.g., Caroline Ektander and Antonia Alampi, *The Long Term You Cannot Afford: On the Distribution of the Toxic* (Berlin: SAVVY Contemporary, 2019), exhibition catalog, accessed February 3, 2023, https://savvy-contemporary.com/site/assets/files/5558/toxicity_handout.pdf.

15 Angeliki Balayannis and Emma Garnett, "Chemical Kinship. Interdisciplinary Experiments with Pollution," Catalyst. Feminism, theory, technoscience 6 No. 1 (2020): Special Section on Chemical Entanglements: Gender and Exposure, 1–10, https://doi.org/10.28968/cftt.v6i1.33524.

16 Michelle Murphy evokes this quote of being divided and yet bound together in her article, yet not quite in the same context. "Alterlife and Decolonial Chemical Relations," *Cultural Anthropology* 32, no. 4 (2017): 494–503.

17 R. Shiloh Krupar, *Hot Spotters Report: Military Fables of Toxic Waste* (Minneapolis: University of Minnesota Press, 2013).

18 For the United States, see US EPA, "National Priority List and Superfund Alternative Approach Sites," last modified June 17, 2024, www.epa.gov/superfund/search-superfund-sites-where-you-live. For Switzerland, see Swiss Environmental Protection Agency, last modified December 4, 2019, www.bafu.admin.ch/bafu/de/home/zustand/daten/geodatenmodelle/altlasten--geodatenmodelle.html; for Austria, see Austrian Environmental Protection Agency, "Altlastenatlas," www.altlasten.gv.at/atlas/verdachtsflaechenkataster.html. For Germany, see the Altlastenkataster, organized by each federal state; for instance, Bavaria: www.lfu.bayern.de/altlasten/altlastenkataster/altlastenauskuenfte/index.htm.

19 Marina Weinberg and Valentina Figueroa, "Politics of Mining. Toxic Heritage in the Atacama Desert," in *Toxic Heritage Legacies, Futures, and Environmental Injustice*, eds. Elizabeth Kryder-Reid and Sarah May (London: Routledge, 2024), 109–123.

20 Angeliki Balayannis, "Toxic Sights," 772–790.

21 Simone Müller and May-Brith Ohman Nielsen (eds.), *Toxic Timescapes. Examining Toxicity across Time and Space* (Ohio: Ohio University Press, 2023).

22 For example, National Research Council, Division on Engineering and Physical Sciences, Board on Army Science and Technology, Committee on Review of the Conduct of Operations for Remediation of Recovered Chemical Warfare Materiel from Burial Sites, *Remediation of Buried Chemical Warfare Materiel* (Washington, D.C., 2012); Leo van Velzen (ed.), *Environmental Remediation and Restoration of Contaminated Nuclear and NORM Sites* (Cambridge: Woodhead Publishing, 2015).

23 United Nations Development Program, "A global treaty to end plastic pollution is in sight," November 2023, last accessed December 14, 2023, www.undp.org/blog/global-treaty-end-plastic-pollution-sight.

24 The literature on both circular economy and zero waste concepts is too vast to cover, for a start: Sabine Oberhuber and Thomas Rau, *Material Matters. Wie eine neu gedachte Circular Economy uns zukunftsfähig macht* (Berlin: Econ, 2021); Pablo del Río et al., *The Circular Economy. Economic, Managerial and Policy Implications* (Cham: Springer, 2021); Robert Crocker and Steffen Lehmann, *Designing for Zero Waste: Consumption, Technologies and the Built Environment* (London: Earth Scan, 2012).

25 Simone M. Müller, "Toxic Commons: Toxic Global Inequality in the Age of the Anthropocene," *Environmental History* 26 (2021): 444–450; Angeliki Balayannis, "Toxic Sights," 772–790.

26 On mining history and contamination, see Johann Paul, *Die Erft im Spannungfeld von Bergbau und Landwirtschaft. Einwirkungen auf ein rheinisches Flussgebiet vom 17. bis ins 20. Jahrhundert* (Siegburg: Rheinlandia Verlag, 1999); Franz-Josef Brüggemeier,

Michael Farrenkopf, and Heinrich Theodor Grütter (eds.), *Das Zeitalter der Kohle. Eine Europäische Geschichte* (Essen: Klartext, 2018); John R. McNeill and George Vrtis, *Mining North America. An Environmental History since 1522* (Oakland: University of California Press, 2017); Nicholas A. Robins, *Mercury, Mining, and Empire. The Human and Ecological Cost of Colonial Silver Mining in the Andes* (Bloomington: Indiana University Press, 2011); Anthony Reid et al., "Chinese on the Mining Frontier in Southeast Asia," in *Chinese Circulations. Capital, Commodities, and Networks in Southeast Asia*, ed. Eric Taglioacozzo and Wen-chin Chang (Durham: Duke University Press, 2011); Tina Asmussen, "Eisen war ich… Kupfer bin ich, Gold werd ich," *Hypotheses (open edition) Materialized Histories. Materielle Kultur und digitale Forschung* (2021), https://mhistories.hypotheses.org/4470; Peter Bakewell, "Mining in Colonial Spanish America," in *The Cambridge History of Latin America. Vol. 2, Colonial Latin America*, ed. Leslie Bethell (New York: Cambridge University Press, 1984), 105–152.

27 Anita Lam, "Choking to Death. True Crime and the Great Smog," in *The Routledge Handbook of Crime Fiction and Ecology*, ed. Nathan Asham (New York: Routledge, 2023).

28 Rachel Carson, *Silent Spring* (Boston: Mifflin, 1962).

29 The literature on these chemical processes is too vast to consider herein. For an overview, consult Müller and Ohman Nielsen (eds.), *Toxic Timescapes*; François Jarrige and Thomas Le Roux, *The Contamination of the Earth* (Cambridge: The MIT Press, 2020) or Benjamin Ross and Steven Amter, *The Polluters. The Making of Our Chemically Altered Environment* (Oxford: Oxford University Press, 2010). On pesticides, see Michelle Mart, *Pesticides, a Love Story. America's Enduring Embrace of Dangerous Chemicals* (Kansas: University of Kansas Press, 2015); Frederick Rowe Davis, *Banned. A History of Pesticides and the Science of Toxicology* (New Haven: Yale University Press, 2014). On waste, see Simone Müller, *The Toxic Ship. The Voyage of the Khian Sea and the Global Waste Trade* (Seattle: Washington University Press, 2023); Roman Köster, *Müll. Eine schmutzige Geschichte der Menschheit* (Munich: C.H. Beck Verlag, 2023). On the military aspect, see Jacob Darwin Hamblin, *Arming Mother Nature. The Birth of Catastrophic Environmentalism* (Oxford: Oxford University Press, 2013); Krupar, *Hot Spotter's Report*. David Biggs, *Footprints of War. Militarized Landscapes in Vietnam* (Seattle: University of Washington Press, 2018).

30 Brett L. Walker, *Toxic Archipelago: A History of Industrial Disease in Japan* (Seattle: University of Washington Press, 2010), xi; Murphy, "Alterlife," 494–503, here 497.

31 Jarrige and Le Roux, *The Contamination of the Earth*, 300.

32 Zhanyun Wang et al., "Toward a Global Understanding of Chemical Pollution: A First Comprehensive Analysis of National and Regional Chemical Inventories," *Environmental Science Technology* 54, no. 5 (2020): 2575–2584.

33 Stacy Alaimo, *Bodily Natures. Science, Environment, and the Material Self* (Bloomington: Indiana University Press, 2010); Nancy Langston, *Toxic Bodies* (New Haven: Yale University Press, 2010).

34 Theo Colborn, *Our Stolen Future* (New York: E. P. Dutton, 1996).

35 May-Brith Ohman Nielsen, "Living with Poison. Exploring Generations as Toxic Timescapes," in *Toxic Timescapes. Examining Toxicity across Time and Space,* eds. Simone Müller and May-Brith Ohman Nielsen (Ohio: Ohio University Press, 2023), 21–48.

36 Linn Persson et al., "Outside the Safe Operating Space of the Planetary Boundary for Novel Entities," *Environmental Science Technology* 56, no. 3 (2022): 1510–1521.

37 Robert D. Bullard, "Confronting Environmental Racism in the 21st Century," *Race, Poverty & the Environment* 10, no. 1 (2003): 49–52.
38 Simone Müller, "Hidden Externalities. The Globalization of Hazardous Waste," *Business History Review* 93, no. 1 (2019): 51–74; Stephan Lessenich, *Living Well at Others' Expense: The Hidden Costs of Western Prosperity* (Cambridge, UK: Polity Press, 2019); Marco Armiero, *Wasteocene, Stories from the Global Dump* (Cambridge: Cambridge University Press, 2021).
39 Müller, *The Toxic Ship.*
40 Bret Ericson et al., "Approaches to Systematic Assessment of Environmental Exposures posed at Hazardous Waste Sites in the Developing World: The Toxic Sites Identification Program," *Environmental Monitoring and Assessment* 185, no. 2 (2013): 1755–66.
41 Richard N. L. Andrews, *Managing the Environment, Managing Ourselves: A History of American Environmental Policy* (New Haven: Yale University Press, 2006); David Larsson Heidenblad, *The Environmental Turn in postwar Sweden: A New History of Knowledge* (Lund: Lund University Press, 2021); Perrin Selcer, *The Postwar Origins of the Global Environment: How the United Nations built Spaceship Earth* (New York: Columbia University Press, 2018).
42 On the governance aspect, see Thomas Weiss, *Governing the World? Addressing Problems without Passports* (Boulder: Paradigm Publishing, 2014).
43 Nancy Langston, *Sustaining Lake Superior*: *An Extraordinary Lake in a Changing World* (New Haven: Yale University Press, 2019).
44 U.S. Congress, Office of Technology Assessment, "Acid Rain and Transported Air Pollutants: Implications for Public Policy" OTA-O-204 (Washington, 1984); Arne Kaijser, "Combatting 'Acid Rain': Protecting the Common European Sky," in *Greening Europe: Environmental Protection in the Long Twentieth Century – a Handbook*, ed. Anna-Katharina Wöbse and Patrick Kupper (Berlin, Boston: De Gruyter Oldenbourg, 2022).
45 T. A. Jackson, "Long-Range Atmospheric Transport of Mercury to Ecosystems, and the Importance of Anthropogenic Emissions: A Critical Review and Evaluation of the Published Evidence," *Environmental Review* 5, no. 2 (1997).
46 David Weir and Mark Schapiro, *Circle of Poison*: *Pesticides and People in a Hungry World* (San Francisco: Institute for Food and Development Policy, 1981). Greenpeace, "Exporting banned pesticides: Fueling the circle of poison. A case study of Velsicol Chemical Corporation's Export of Chlordane and Heptachlor" (1989).
47 Alice Crow, "Breaking the Circle of Poison: EPA's Enforcement of Current FIFRA Export Requirements," *The Georgetown International Environmental Law Review* 4, no. 319 (1992).
48 U.S. General Accounting Office, "Pesticides: Better Sampling and Enforcement Needed on Imported Food" GAO/RCED-86-219 (1986).
49 Greenpeace, "Exporting banned Pesticides," 21.
50 Crow, "Breaking the Circle of Poison".
51 Kate Brown, *Manual for Survival: A Chernobyl Guide to the Future* (New York: W.W. Norton & Company, 2019).
52 Suroopa Mukherjee, *Surviving Bhopal* (New York: Palgrave Macmillan, 2016).
53 Stephen O. Andersen and K. Madhava Sarma, *Protecting the Ozone Layer* (London: Earthscan, 2002).
54 Ulrich Beck, *Risk Society. Towards a New Modernity* (London: Sage Publications, 1992; Ulrich Beck, *Ecological Politics in an Age of Risk (Cambridge: Polity Press, 1995).*
55 Beck, *Risk Society*, 48.

56 Frank Uekötter, “Die Katastrophe im Zeitalter ihrer elektronischen Reproduzierbarkeit, oder: Wege zu einer Historisierung der Risikotechnologien,“ *Werkstatt Geschichte* 63 (2013): 101–107.
57 World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987).
58 Iris Borowy, *Defining Sustainable Development for Our Common Future* (Abingdon: Routledge, 2013).
59 David Naguib Pellow, *Resisting Global Toxics* (Cambridge: MIT Press, 2007).
60 Müller, *The Toxic Ship.*
61 Literature on the Anthropocene, both in the natural sciences and the environmental humanities, is vast and rapidly growing. A good introduction from the Environmental Humanities is Helmut Trischler, “The Anthropocene”, *NTM* 24 (2016): 309–335, or Clive Hamilton, Christophe Bonneuil, and François Gemenne (eds.), *The Anthropocene and the Global Environmental Crisis* (London: Routledge, 2015). For environmental history responses, see Christophe Bonneuil, Jean-Baptiste Fressoz, and David Fernbach, *The Shock of the Anthropocene: The Earth, History and Us* (London and New York: Verso Books, 2016) or Dipesh Chakrabarty, *The Climate of History in a Planetary Age* (Chicago and London: University Press of Chicago, 2021).
62 Eduardo Missoni, Guglielmo Pacileo, and Fabrizio Tediosi, *Global Health Governance and Policy. An Introduction* (London: Taylor and Francis Group, 2019).
63 There is, for example, the Capitalocene, the Wasteocene, the Plantationocene, the Chlutlocene. See Jason W. Moore (ed.), *Anthropocene or Capitalocene? Nature, History, and the Crisis of Capitalism* (Oakland: PM Press, 2016); Armiero, *Wasteocene*; Donna Haraway, “Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin,” *Environmental Humanities* 6, no. 1 (2015): 159–65.
64 Chakrabarty, The Climate of History, 2021; Timothy Morton, *Hyperobjects. Philosophy and Ecology after the End of the World* (University of Minnesota Press, 2013). Kregg Hetherington, “Introduction: Keywords of the Anthropocene”, in *Infrastructure, Environment, and Life in the Anthropocene*, ed. idem. (Durham: Duke University Press, 2019).
65 Müller, “Toxic Commons”.
66 Murphy, “Alterlife”.
67 Elinor Ostrom, *Governing the Commons. The Evolution of Institutions for Collective Action* (Cambridge UK, Cambridge University Press, 1990); Elinor Ostrom, *Understanding Institutional Diversity* (Princeton University Press, 2005).
68 David Bollier and Silke Helfrich (eds.), *The Wealth of the Commons* (Amherst: Levellers Press, 2012), xi.
69 Naomi Klein, “Reclaiming the Commons,” *New Left Review* 9, no. 9 (2001): 81.
70 Peter Linebaugh, *The Magna Carta Manifesto* (Berkeley: University of California Press, 2008).
71 Fredrik Albritton Jonsson and Carl Wennerlind, *Scarcity. A History from the Origins of Capitalism to the Climate Crisis* (Cambridge: Harvard University Press, 2023); Roger Perman (ed.), *Natural Resource and Environmental Economics* (Harlow and Munich: Pearson Education Limited, 2011).
72 On commons and property rights, see Carsten Herrmann-Pillath, “The universal commons: An economic theory of ecosystem ownership,” *Environmental Economics* 208 (2023): 1–11.
73 Hugo Grotius, *Mare Liberum* (1609); With Toxic Commons we are explicitly not invoking the notion of a res nullius that belongs to no one, e.g., Karin Mickelson, “The

Maps of International Law: Perceptions of Nature in the Classification of Territory," *Leiden journal of international law* 27, no. 3 (2014): 621–639.

74 Garrett Hardin, "The Tragedy of the Commons," *Science* 162, no. 3859 (1968): 1243–1248.

75 Ralph Ghoche and Unyimeabasi Udoh, "A Commons for Whom? Racism and the Environmental Movement," in *Transforming Education for Sustainability*, ed. Maria S. Rivera Maulucci, Stephanie Pfirman, and Hilary S. Callahan (eds) (Cham: Springer, 2023), 75–88.

76 Andrew P. Follett, Brigham Daniels, and Taylor Peterson, "The Tragedy of Garrett Hardin's Commons," in *The Cambridge Handbook of commons research innovations*, ed. Sheila R. Foster and Chrystie Flournoy Swiney (Cambridge: Cambridge University Press, 2021).

77 Max Liboiron, *Pollution is Colonialism* (Durham: Duke University Press, 2021); Alexis Shotwell, *Against Purity: Living Ethically in Compromised Times* (Minnesota: University of Minnesota Press, 2016).

78 Anna Lowenhaupt Tsing et al., *Arts of Living on a Damaged Planet: Ghosts and Monsters of the Anthropocene* (Minneapolis: Minnesota University Press, 2017).

79 See, for instance, Oliver Schutter and Tom Dedeurwaerdere, *Social innovation in the service of social and ecological transformation. The rise of the enabling state* (London: Routledge, 2022).

80 Salcido, "The Rocky Mountain Arsenal," 1399–1430, here 1402.

81 Ibid., 1412.

82 Ibid., 1412.