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The Ecological Life of Industrial Waste

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ABSTRACT

The post-depositional afterlife of an archaeological site is often viewed as the least important aspect of its history and outside of traditional archaeological interest. In the case of industrial sites, this elision ignores one of the most important aspects of industrial history, namely the long-term effects of toxic waste. In an era where industrial pollution and anthropogenic climate change are rapidly changing the future of life on this planet, the stakes of understanding the effects of industrial waste are vital. This article outlines a reflexive, ecologically focused archaeology that interrogates the afterlives of industrial waste, not as a method to get back to the history of production, but as a means for taking seriously these afterlives as a defining characteristic of life in the Anthropocene. Using the concept of the *ecological lives of industrial waste* to explore the (post)industrial history of Mill Creek Ravine—a historically important industrial area in Edmonton, Alberta— this article argues that the decomposition of industrial waste serves as both a medium for long-term harms, as well as the locus for emergent relations and critical investigation. [archaeology of the Anthropocene, industrial archaeology, archaeology of toxicity, human/environment relations, industrial waste]

> *"What the archaeologist disturbs is not the remains of a once living community, stopped as it were, at a point in time; what he does interrupt is the process of decomposition."*
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> (Robert Ascher, 1961)

The past seeps into the present. It persists in ways that are both stubborn and malleable; inconsiderate chunks that we are left to wrestle over. This paper focuses on one kind of persistent object, and one kind of seepage: the toxic decomposition of industrial waste. Archaeology and heritage studies have long been interested in the ways that historical materials resonate (De Nardi 2014; Harrison 2013; Hamilakis 2007, 2009; Rizvi 2019; Smith 2006; Smith and Waterton 2013). Far from being inert representations of the past—these materials are lively, political, and potent in the present. As the other wonderful contributors of this volume have noted (see Taylor and Sesma [2022] Chapter 1; Danis [2022] Chapter 7; Lorenc [2022] Chapter 8), this focus on the politics of material resonance shares compelling intersections with the archaeology of the contemporary; a project that wishes to mobilize archaeological methods and sensibilities to study the social processes of the recent past (Dawdy 2010; De León 2015; González-Ruibal 2008). Here, I want to draw on the critical and reflexive insights from both projects to trace the toxic afterlives of industrial waste. By this I mean to archaeologically reconstruct the ways that industrial waste resonates both socially and ecologically after its deposition. This archaeological approach to the social and ecological effects of industrial waste, what I term the archaeology of toxicity, is a vital component of a broader archaeology of the Anthropocene (Stewart 2017; Stewart, Jungkind, and Losey 2020; Stewart forthcoming). To study an era defined by drastic levels of environmental degradation and environmental inequity, archaeologists of the Anthropocene must extend their critical and reflexive insights to questions of toxic harm, slow violence, and ecological devastation. In order to investigate the long-term effects of industrial capitalism upon the environment and upon ourselves, archaeologists need to focus not only on industrial heritage or labor history (Beaudry 1987; McGuire 2014; Mrozowski and Wurst 2016; Paynter 1988;

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Shackel 2011), but on the long decomposing afterlives of post-industrial landscapes.

Post-industrial landscapes represent a quintessential "old place" (Taylor and Sesma [2022] this volume, Chapter 1) of the contemporary world. Abandoned industrial sites are landscapes defined by the lingering accretion of obsolete production and waste, materialized in both the monumental and the microscopic. The industrial history of a landscape does not end with the abandonment of industrial production. Instead, the persistence of industrial ruins and detritus (what I broadly term industrial waste) continues to mediate the production and reproduction of the abandoned landscape. This chapter outlines a reflexive, ecologically focused archaeology that interrogates the afterlives of industrial waste, not as a method to get back to the history of production, but as a means for taking seriously these toxic decompositions as a defining characteristic of life in the Anthropocene. Using the concept of the *ecological lives of industrial waste* to explore the (post)industrial history of Mill Creek Ravine—a historically important industrial area in Edmonton, Alberta—this article argues that the decomposition of industrial waste serves as both a medium for long-term harms, as well as the locus for emergent relations and critical investigation.

Post-Depositional Afterlife

The post-depositional afterlife of an archaeological site is often viewed as the least important aspect of its history and outside the focus of archaeological endeavor. Most archaeological approaches view abandonment as the end of the archaeological story, the moment when the natural processes of decay start to undo the materialized social structure that humans have left behind. Artifacts become buried in the ground, decomposing amidst the soil, microbes, and worms. Old buildings begin to crumble and crack. The role of the archaeologist is to intervene, preserve these objects, and reconstruct the social structure that produced them.

Those studies that do take the decaying afterlives of an archaeological site seriously, focus on this afterlife not as an end unto itself but as a lens through which to better understand pre-depositional life. This approach is exemplified by the Schifferian inspired studies of site formation processes. Schiffer argued that archaeologists had to stop assuming that the sites they were excavating were pristine representations of past life, what he termed "the Pompeii Premise" (1985). Instead, these sites were the result of past human life combined with an array of natural (N-transforms) and cultural (C-transforms) site formation processes "that create the historic and archaeological records" (Schiffer 1987, 7). By studying these different post-depositional transformations, the archaeologist could better reconstruct the pre-depositional history of a site. In a different vein, recent scholarship has emphasized the post-abandonment afterlives of modern ruins as having critical weight (Boym 2003; Dawdy 2010; González-Ruibal 2008; Gordillo 2014; Grandin 2013). Inspired by the critical work of Walter Benjamin, these scholars have identified ruined landscapes as sources of critical insight, sites that trouble the totalizing claims of power and the easy periodization of modern progress (Boym 2003). Manifested in the rotting roofs and disintegrating concrete, pierced and fragmented by roots, the material cycles of decay and growth poke holes in industrial factories and the promise of wealth and progress they conjure. In both cases, these scholars tend to approach decay as a story of negation, one that serves as a vehicle for analysis, but that is largely absent of any valuable information *in its own right*.

A notable exception to this generally negative view of post-depositional afterlives comes from waste studies. Rummaging through modern landfills, archaeologists and anthropologists have highlighted the vital importance of one aspect of these post (or at least *in medias res*)-depositional afterlives, namely waste disposal (Hawkins 2006; Humes 2012; Rathje and Murphy 2001; Reno 2015). Starting with seemingly valueless objects, waste studies has uncovered the vital meanings, institutions, and sociality that emerge out of the management, circulation, and transformation of waste. At the same time, waste studies largely emphasize a single trajectory of the afterlives of objects (namely disposal) and elide the vast majority of social and ecological entanglements that emerge out of post-depositional decay.

In writing off decay as a process of negation, or singularly emphasizing the sociality of disposal, both approaches elide the particular relations of archaeological contexts. As Matt Edgeworth argues through the concept of the *archaeosphere*, the archaeological record is not a passive record but an extremely "vibrant and active set of deposits" that continue to influence local ecologies (Edgeworth 2018, 19). These influences range from the multispecies ecologies growing over archaeological rubble, communities recycling and reusing ruined material, as well as the layered interpretations of the ruins as they decay. In the context of modern industrial landscapes—covered with ruins and waste—this elision obscures the long-term effects of industrial remains on the landscape. Attention to the social and historical relations immanent to this decay reveals how industrial waste and industrial ruins remain dynamically engaged with the world long after they are deposited and abandoned. Undoubtedly, all archaeological remains affect their local ecologies as they decay in the soil (Edgeworth

2018); however, in an era defined by anthropogenic climate change driven by industrial production, pollution, and exploitation, the stakes of the afterlives of industrial waste are paramount.

Industrial Waste and the Anthropocene

Over the past two decades, scholars have identified the contemporary era as marking a drastic transformation in human-environment relations. In order to better emphasize the totality of this transformation, scholars across the humanities and social sciences have turned to the concept of the Anthropocene (Chakrabarty 2009; Clark 2015; Eckersley 2017; Ellis 2017; Lidskog and Waterton 2016; Tsing et al. 2018). Introduced by Paul Crutzen and Eugene Stoermer (2000), the Anthropocene identifies the human impact on the environment following the Industrial Revolution as so substantial that it warrants its own geological period. While popular, the term is not without its detractors. As scholars like Erik Swyngedouw (2015) and Jason W. Moore (2015) have laid out, the concept of the Anthropocene essentializes a singular *anthropos*, and seems to suggest that it is humanity writ large that is to blame, rather than a historically particular form of human activity. At its worst, the term fails to distinguish the historically situated forms of relations that are to blame for the Anthropocene, as well as the different experiences of environmental victimhood it engenders, and reinscribes a Malthusian terror of carrying capacity at the global scale.

Dissatisfied with its use, theorists have proposed a series of other analytics to describe the contemporary era: Capitalocene, Cthulucene, Plantationocene, Necrocene, Supermodernity, and so forth (González-Ruibal 2019; Haraway 2015; McBrien 2016; Moore 2015; Moore et al. 2019). All of these alternative terms have their benefit, highlighting different nuances and textures of history and geography that prove to be useful for investigating the contemporary era. However, due to the purchase of the concept of the Anthropocene across a broad array of scientific and social scientific disciplines, the research and critique which occur under the sign of these proposed eras inevitably take place within a broader conversation of the Anthropocene. The widespread legibility of the term the Anthropocene has led to a seemingly inevitable truth that the interdisciplinary conversations we need to be having about climate change, industrial capitalism, and environmental justice will be taking place under the sign of the Anthropocene. As Elaine Gan, Anna Tsing, Heather Swanson, and Nils Bubandt point out, rather than rejecting the term, it is a more useful approach to argue for more nuanced definitions of the term: "[o]ur use of 'Anthropocene' intends to join the conversation-but not accept the worst uses of the term" (Gan et al. 2017, 3).

Following this approach, what defines the Anthropocene is not simply the effects of an undifferentiated *species* upon the globe, it is a certain form of human activity: industrial capitalism. Over the past two hundred years, industrial capitalism has remade the globe on social, biological, and geological levels. On one hand, this era is defined by the massive power of industrial production, the standardization of commodities, the exploitation of vulnerable populations, and the accelerating search for new resources to manufacture; on the other, it is defined by the endless production, disposal, and accumulation of industrial waste. What distinguishes the Anthropocene from other understandings of modernity qua capitalism, is taking seriously the long-term social and ecological impacts of industrial waste as a vital component of how industrial capitalism has remade the world. Driven by the boom-and-bust cycles of capitalism, industrial production leaves behind a vital and active material record in its wake. These material remains drastically transform ecosystems and harm human and nonhuman communities as they decay.

While defined by the powerful dynamic of capitalism, the era of the Anthropocene cannot be explained away by an analysis of class, the relations of production, or a purely theoretical analysis of the logic of capital. Instead, it must be understood through the entangled relations of production and waste. That is, the manner in which lives are produced and reproduced according to the dynamic of capitalism within landscapes haunted by industrial waste. The reproduction of life in the Anthropocene is dependent upon the challenges of a constantly accelerating dynamic of capitalism that exploits the vulnerable and empowers the wealthy, as well as the accumulation of two centuries worth of "deteriorating industrial infrastructure and landscapes dotted with toxic waste" (Fortun 2014, 310). These two features of contemporary life are intertwined. Vulnerable populations are not just exploited by industrial capitalism, they are disproportionately forced to build their lives exposed to the toxic debris of industrial production.

At the same time, the long-term social and ecological afterlives of these anthropogenic transformations do not simply map on to the goals and values of capitalist logics. The projects of value production and standardization that define capitalism have also produced endless disasters, the result of failures to contain the uncontainable residue of production (Fortun 2014). The persistent afterlives of waste continue to form and deform landscapes, communities, and biologies and in doing so intersect with (and complicate) the ongoing relations of value-production and class re-production. The accumulation of industrial waste in the environment produces landscapes that "are increasingly hostile to capital accumulation and can be temporarily fixed only through increasingly costly and toxic strategies" (Moore 2015, 1). This accumulation of waste, and the detrimental effects it has on the production of value and the reproduction of life is what Moore terms *negative value*. Undercutting the very ability of our planet to reproduce life, the accumulation of negative value not only threatens capitalist production, but life itself.

On a macro-scale, Moore's concept of negative value usefully articulates the question of waste to both the process of production as well as the oncoming crisis of ecology that emerges out of the infinite drive for capitalist expansion in a finite world. On the micro-scale, however, even while noting how the feedback loop of waste becomes entangled into the reproduction of life under capital, Moore's concept of negative value largely ignores the particular histories of different forms of industrial waste. While the accumulation of industrial waste may be negative from the perspective of capitalism, this perspective does not exhaust the wide array of relations that define the afterlife of waste.

Abandoned by business, industrial ruins and decaying waste serve as the fecund and toxic terrain from which new combinations of people, plants, and social relations emerge out of the contradictions of capitalist exploitation. These relations do not map simply upon the binary of value or negative value. Decaying industrial waste harms certain communities, but aids others. Certain ecologies are extinguished, while others flourish. Fungi and bacteria grow around decomposing waste, weeds grow over decaying industrial ruins, and impoverished communities set up camps in and around abandoned buildings. In the decaying industrial remains, these communities represent both the harms of toxic entanglements, as well as tactics of resilience and survival (Gan et al. 2017). This is not to claim that there is an outside to the Anthropocene, an idealized location where capitalism has not rearranged social relations and biologies. Instead, it points to the alternative forms of life that emerge out of the strange new exchanges and relations that industrial capitalism and its waste engender.

Ecological Lives of Industrial Waste

In ignoring the complex afterlives of industrial waste, and understanding waste only in relation to the logic of capitalism, the binary of value/negative value falls victim to the fetishized vision of the world that makes capitalism appear as a totalizing force and the Anthropocene as inescapable. If we are to "stem the tide of ruination" of the Anthropocene (Gan et al. 2017, 1) and "make the Anthropocene as short/thin as possible" (Haraway 2015, 160), it is not enough to merely critique the cycles of destruction. We have to attend to both the horrors of anthropogenic destruction as well as the entangled multispecies relations and symbioses that are immanent and resilient to this destruction (Tsing et al. 2017). To track these entangled relations and the manner in which they articulate to anthropogenic destruction, I propose a new archaeological method: the "ecological lives of industrial waste." This method tracks the trajectories of industrial waste across time, extending the methodological fetishism of the object biography made famous by Arjun Appadurai (1986) and Igor Kopytoff (1986).

In the face of an increasingly commoditized capitalist world, Arjun Appadurai famously called for a renewed interest in the social lives of things, a "methodological fetishism" that tracks the particular lives and histories of objects (Appadurai 1986, 5). Following objects as they move through the world—produced, bought, sold, and consumed—demonstrates how the life of the material object far exceeds its role in the capitalist market: "the commodity phase of the life history of an object does not exhaust its biography" (Appadurai 1986, 15). An object may exist as a standardized commodity during one period of its life—defined by its equivalency with other objects—it also goes through processes of singularization, where it is increasingly entangled in particular relations with people, places, and things (Kopytoff 1986). Things can move in and out of commodity status, from a commodity to a gift, an heirloom, or an artifact depending on the sets of relations with which an object is connected at any particular place and time. While industrial capitalism may serve as the conditions of possibility for the manufacturing of these objects, it does not and cannot determine the course of the object's life. Instead, exploring the social lives of objects serves as a method to highlight the particularities of practices and ways of life that develop under capitalism, yet remain undetermined by industrial capitalist production and circulation. To see life in the Anthropocene as both defined by industrial capitalism, and yet not completely determined by capitalist production and exchange, the methodological approach of the social life of things must be expanded to focus not just on commodities, gifts, heirlooms, and icons, but on the by-products of the productive forces themselves. Just as a social life of an object reveals the myriad different relations obscured by the category of commodity and exchange value, so too the social life of industrial waste reveals the different relations that define industrial waste beyond its appearance as useless refuse or Moore's (2015) characterization of it as a form of negative value.

Tracking these relations over time is what I call the method of the ecological lives of industrial waste. This new methodological fetishism tracks the trajectory of industrial waste after it is produced and deposited as part of commodity production. By *ecological lives*, I refer to the changing relations that develop between industrial waste and the array of human and non-human actors that interact with it across its post-depositional life. While deposited as an undifferentiated mass, industrial waste is singularized by the particular relations with which it is entangled. Over time, as the waste decays and the environment transforms, these relations shift.

Just as the social life of things highlighted the more-than-commodity relations that emanate out of commodity exchange, the ecological lives of industrial waste emphasize the more-than-negative-relations that emanate out of the negative side of industrial production (the output of industrial waste). This approach tracks the afterlives of industrial waste to better understand the broader texture of human–nonhuman relations over the long-term in the Anthropocene. Following the changing relations of waste over time serves as an entry point into the myriad ecologies, structures of meaning, and networks of production and consumption in which industrial waste is entangled. Studying the ecological lives of industrial waste illustrates the complexity of growth and devastation that defines (post)industrial landscapes beyond any notion of positive or negative value.

Mill Creek Ravine

Mill Creek Ravine, one of the first major industrial areas in Western Canada, represents a paradigmatic (post)industrial landscape of the Anthropocene—that is, a landscape still defined by its long-since-abandoned industrial past. Developed in 1902 as a major center for coalmining and meatpacking in Edmonton (Alberta), Mill Creek Ravine was abandoned by industry in the 1920s. Although it is now a densely forested city park, Mill Creek Ravine is still filled with waste and the creek itself remains the most polluted in Alberta (MacEwan 2017). Overgrown with thick brush, the ravine is littered with the remnants of its industrial past (Figure 6.1): degraded concrete slabs, deposits of mining overburden, and cow bones seen eroding out of the creek bank. These strewn objects recall a particular industrial history of the ravine, the rise and fall of meatpacking and coal industries in the early twentieth century. However, these decaying masses of industrial remains are also part of another history: the ongoing, (post)industrial history of Mill Creek Ravine. Deposited and abandoned as valueless waste, these remains have been decaying in the ground for the past century. As they have decayed, they have become entangled with a range of communities, both human and non-human. This article maps the trajectory of that industrial waste—its ecological life—as it has moved in and out of different (non-mutually exclusive) relations and exchanges that far exceed the category of non-valuable (or negative-value) waste: salvageable resource, hidden toxin, and fertilizer. The biography of industrial waste's afterlife reveals how its decay has harmed vulnerable populations and served as a continuation of the exploitive relations that define industrial capitalism in the first place. And yet, this decaying waste has also served as the compost for new and unexpected relations and possibilities.

Mill Creek is a fast-moving creek that runs roughly north to south, emptying into the North Saskatchewan River through a steep ravine. In 1902, the Edmonton, Yukon and Pacific Railroad company built a railroad through the ravine, linking Edmonton to the rest of Canada for the first time. Drawn by the transportation opportunities of the railway, and the booming population of Edmonton, the ravine became the bustling center for industrial activity in the city. Housing four modern industrial meatpacking plants along the railway, Mill Creek Ravine became the epicenter of meat processing in the city, and hub for meat export to the rest of Canada. One of the most important of these four meatpacking plants was Vogel's Meats. Importing new refrigeration technology and meatpacking techniques from Chicago, Vogel's represented the pinnacle of modern industry in Edmonton (*Edmonton Bulletin*, 1903).

More than just a hub for transportation and meatpacking, the importance of Mill Creek Ravine as a metropolitan center for industrial production was bolstered by the thick veins of coal that ran through its banks. By 1908, the Twin City Coal Mine had begun operations directly downstream of Vogel's Meats, digging coal out of the western bank of the ravine, eventually becoming the deepest coal mine in the city. This plentiful coal provided cheap heat and cheap electricity and was exported across Western Canada. As Mill Creek Ravine transformed into an epicenter for industrial production, it became one of the main sources for wages and wage labor in the otherwise rural economy. Coalmining and meatpacking served as two of the major sources of employment for the rapidly growing city. Looking for work, incoming settlers began to populate the areas surrounding Mill Creek Ravine. Unable to afford legal lots of land, many of the most impoverished settlers took up residency in the ravine, adjacent to the railroad and the factories. A large number of these settlers set up an informal shantytown at the northern end of Mill Creek Ravine. Known as Ross Acreage, this community of industrial laborers built small shacks along the creek banks and up the steep banks of the

Figure 6.1. The decaying and growing entrance to Twin City Coal Mine (photo by Haeden Stewart). [This figure appears in color in the online issue]

ravine. As the industries of Mill Creek Ravine thrived, residents of Ross Acreage worked long punishing hours down in the coal mines or on the killing floors of the packing plants.

Refuse

Separating the valuable resource from its natural form, the industrialized processes of both meatpacking and coalmining produced masses of material that were deemed non-valuable refuse. As they dug deeper into the veins of coal under Mill Creek, the miners of the Twin City mine recovered thousands of tons of ore sold for a profit, as well as thousands of tons of unusable rock, dust and soil that were deposited in piles along the ravine. As thousands of cows, pigs, and sheep were slaughtered, packing plants were left with tons of blood, guts, and excrement. In order to get rid of this refuse, the plants dumped it directly into the ravine and creek.

Out of sight from the middle-class families living above, Mill Creek Ravine was viewed as an expendable landscape, perfect for the deposition of industrial waste. Archaeological excavations of Vogel's Meats packing plant provide an example of the extent of waste dumping throughout the ravine. Excavation revealed Vogel's Meats' waste pile adjacent to the creek, as well as a network of pipes that drained wastewater from its killing floors into the creek (Figure 6.2). Blood, fat, and hair were washed off the factory floor and drained into Mill Creek. Bones, animal hair, bullet casings, broken barrels, and slaughtering tools were tossed onto the creek banks and left to rot. No pit was dug to contain the waste, no attempt was made to move it further afield or to contain it. Assuming that all four meatpacking plants in the ravine practiced similar waste disposal strategies, it is likely that the creek would have been overwhelmed by the daily deposits of animal waste. Blood and other organic waste dumped into the creek promoted its eutrophication, the deoxygenation of the creek, and the killing of much of its wildlife.

Figure 6.2. Pipes running through the concrete floor of Vogel's Meats were part of the packing plant's cleaning system. Water drawn from the creek was used to clean the blood and solid waste from the packing floor, after which it was pumped into the ravine and the creek (photo by Haeden Stewart). [This figure appears in color in the online issue]

Along with the dumping of organic waste, the packing plants also dumped the waste produced through the running of the factory itself. Powered by a large coal-heated boiler, Vogel's burnt tons of coal to keep its machinery running. After the coal was burnt, the plant dumped clinker—the glassy and friable by-product of burning coal—along the creek bank. Based on excavations, it is estimated that roughly three to four tons of clinker were left behind from Vogel's twelve years of production alone. Clinker, which is the remnants of all the non-combustible materials found in coal, often contains high concentrations of heavy-metals and calcium oxide. Leaching out of the waste piles and the overburden piles, waste did not stay put, but spread throughout the ravine via the creek. As the creek flowed and flooded annually, it deposited these heavy metals across the ravine floodplain and throughout the garden plots of the residents of Ross Acreage.

Resource

By 1914, after only twelve years of business, Vogel's Meats shut its doors. The war in Europe and a busted real estate bubble in Edmonton had sent interest rates skyrocketing. The cheap capital that industries in Mill Creek Ravine relied upon dried up, and one by one the meatpacking plants shut their doors. Twin City coal mine, the last of the major industrial endeavors in the ravine, shut its doors in 1923. With their jobs disappearing, the occupants of Ross Acreage were forced to abandon their homes, moving to other parts of the city.

For almost five years the ravine was left deserted, with weeds and trees growing over the ruins of the plants and mine. By the late 1920s, the economic malaise in Edmonton deepened, eventually culminating in the crippling of the Prairie economy during the Great Depression (Grey 2003).

High levels of debt and a decade-long drought ruined small farms and pushed destitute farmers and their families into urban centers like Edmonton. Deeply indebted, unable to find work, and unable to afford rent, these families settled in the least desirable areas of the city. Strewn with ruins and unwanted by the government, business, or local Edmontonian residents, Mill Creek Ravine was one of the few places in the city where destitute families could settle. By the crash of 1929, hundreds of impoverished farming families had resettled in Mill Creek Ravine, living in and around the old ruins, and resettling the abandoned plots of the former working-class community of Ross Acreage.

For these incoming families, this ruined landscape was not valueless at all. The extensive industrial ruins and abandoned plots provided salvage opportunities to farmers who had no savings and no wages with which to purchase building materials. Excavation of two different family homes in Ross Acreage show that incoming residents subsisted off the ruins and the weedy ecology that grew over them. Settling near the remains of an abandoned shack, a German family named Bruner built their own home out of a bricolage of wood, brick, and tarpaper salvaged from surrounding ruined shacks. Firebricks, scavenged from an industrial furnace, were used to buffer the wooden home from the heat of a coal-fire stove. Using fireworks and tire-irons, slabs of concrete and brick were removed from nearby factory buildings and used to shore up makeshift dwellings.

The dense growth that covered the old industrial lots and eroding mining banks provided opportunities for hunting. Faunal remains recovered from two family homes during this period show a clear reliance on locally hunted game. Half of all bones identified came from fish and small wild game that would have been living in the ravine: pike, hare, muskrat, squirrel, and rabbit. The presence of .22LR small game cartridges and a small leg trap further testifies to the importance of trapping and hunting for daily sustenance. Prior to this occupation, residents of Ross Acreage had relied extensively on processed industrial meat for their subsistence. Evidence of terracotta gardening pots, garden compost, and two articulated chicken skeletons suggest that along with hunting, residents supplemented their diets through gardening and raising chickens. The decrease in purchased food, the increase of locally raised food, and the rise of hunting all point to the lack of cash wages in the community, and the necessity of relying on the ravine's resources.

With the closing down of most local mines and the inability of occupants to afford or access natural gas, residents scoured the local environment for free heating sources. Excavation of the Bruners' shack show that the family dug a mining shaft into the side of the ravine behind their home, following a coal vein. The ad hoc nature of digging for coal throughout the ravine is evidenced by the incredibly poor quality of coal that families like the Bruners were burning. In an effort to stay warm through the bitter winters, residents frequently burned coal that was barely more than creek clay. Lacking the resources to pay for heating, the community also lacked the governmental recognition that would have given them access to city water services. Instead, unsanitary creek water collected downstream of the industrial ruins was used for most domestic activities (cleaning, cooking, and gardening) (Whitelaw, 1929).

Toxin

For over a decade, as Edmonton continued to be mired in the Depression, the residents of Ross Acreage depended on the ravine for most of their necessities. Subsisting off of a post-industrial landscape, they did not just interact with industrial waste as a salvageable resource, they were also exposed to it as a harmful toxin. As they hunted, gardened, and salvaged, they engaged with a landscape that was suffused with the caked residues of coal mining waste. Leaching out from the Twin City Coal mine, a five-minute walk upstream, heavy metals were spread across the valley floor that hosted many Ross Acreage residences.

Analysis of soil samples recovered from the area surrounding one Depression-era home showed that seasonal flooding distributed heavy metals associated with coal throughout the settlement—specifically arsenic, beryllium, cadmium, lead, nickel, and antimony. One sample—a layer of river silt and soil that had been deposited during the height of Twin City production—had a beryllium concentration of 1.54 ppm. This is six times greater than the "maximum tolerable soil concentration" for agricultural or garden soil (0.2 ppm) according to the World Health Organization (Moterjemi 2014, 112). The same soil layer had a concentration of 8.9 ppm of arsenic, higher than the 8.0 ppm maximum tolerable concentration for agricultural or garden soil (Moterjemi 2014, 112). This was the soil in which residents of Ross Acreage were growing their vegetables, and the soil on which their children played.

Both arsenic and beryllium are toxic heavy metals, with potentially severe health outcomes caused by even low levels of chronic exposure. Beryllium is a common byproduct of coalmining, entering the air through burning coal and entering the water system through run-off and industrial waste. Long-term exposure to elevated levels of beryllium can cause a condition called chronic beryllium disease (Cooper and Harrison 2009). This disease, while slow to present symptoms, can cause weakness, lethargy, weight loss, and heart disease. Similar to beryllium, arsenic is released into local waterways through runoff from coalmining, as well as from coal storage facilities and mining spoils (Kolker et al. 2006). Arsenic bioaccumulates in plants and animals, particularly in tubers and leafy vegetables grown in contaminated soil (Bhattacharya et al. 2012; Chen et al. 2013). Chronic exposure to elevated levels of arsenic causes long-term health problems: liver and kidney damage, along with nerve damage and skin thickening (Ratneike 2003).

Long after industry abandoned Mill Creek, the people living in Ross Acreage were exposed to elevated levels of arsenic and beryllium from the smoke of the coal that heated their homes, the water in which they washed their clothes, the animals they hunted, and the vegetables grown in their gardens and consumed at their tables. Heavy metals like arsenic and beryllium accreted in the bodies of Ross Acreage residents because lives are recursive, with exposure occurring according to the tempo of gardening and growing food in the garden. While concerned over the unhygienic nature of using raw creek water, the residents of Ross Acreage were likely completely unaware of the microscopic harms that saturated the soil they gardened in. This state of non-legible harm is what Fortun (2001) would call toxicity, a relationship between microscopic objects and living bodies defined by a latent harmfulness. While heavy metals like beryllium and arsenic can kill quickly, the more common harm—what Rob Nixon (2011) calls *slow violence*—is through long-term exposure, in which toxins accrete into the body, causing slow deaths, mutations, and disease. Due to the latency of these toxins, and the long-term nature of their harms, the symptoms are often illegible or imperceptible.

Fertilizer

After two decades of subsisting off of the landscape of the ravine, the residents of Ross Acreage were forcibly removed from their homes by the municipal government in 1954, once again leaving the ravine deserted. But while humans left the ravine, the masses of decaying industrial waste continued to influence the growth of the local ecology. As the residents of Ross Acreage abandoned their homes, they left behind piles of their own waste and the gutted remains of their homes. They also left behind the hedgerows that, in the absence of a legally recognized survey, had marked their ad hoc property lines. Over the next two decades, these hedges began to grow beyond their rows, and quickly spread across the ravine. The bush that made up these hedges, *Caragana arborescens*, is a virulent plant that still thrives in the marginal and toxic soils of Mill Creek Ravine. As toxins limited the growth of native species, the invasive and hardy caragana quickly spread, outcompeting other plants, and taking over the ravine. Rather than impeding caragana's spread, industrial waste facilitated its growth.

Originally introduced by the Canadian government, caragana was seen as a plant that could help civilize the Prairies. A tall unassuming shrub with yellow flowers, caragana foliage is very dense, serving as an excellent wind break and fence. Highly prized by early settlers, the extensive root system of the caragana makes it resistant to high winds and tolerant of drought; it also makes the shrub useful for preventing erosion (George 1953). Caragana is most impressive in its ability to flourish and adapt to highly adverse climatic conditions and poor soils (Dietz and Slabaugh 1974). Caragana seedlings grow fast and thrive in a wide range of soil types, including highly alkaline soils, dry soils, and polluted soils (Watson 2013). Rather than inhibiting growth, the marginal, alkaline (steeped in clinker, calcium oxide, and other burnt coal byproducts) and toxic soils of Mill Creek were perfect for caragana.

Caragana spread across Mill Creek Ravine over the same period the city began to use the area as a site for city drainage. By the 1950s, Mill Creek Ravine became a vital component of the city's rapidly expanding urban waste infrastructure. To deal with the growing city and increasing amounts of storm run-off, twenty-one storm drains were connected to Mill Creek Ravine. Draining an area far larger than its catchment, these drains increased the amount of water flowing into Mill Creek during storms by a factor of six (Hawrelak 1974). Subsequently, flooding in Mill Creek became a serious problem. Rainstorms would cause flash floods, causing serious erosion. As flooding ravaged the banks of Mill Creek Ravine on a yearly basis, the deep networks of caragana root were one of the sole forces that combated erosion and helped maintain topsoil. Not only did caragana maintain the topsoil, but it helped fix valuable nutrients in the soil. Despite its otherwise colonizing tendencies, caragana can also aid in the growth of other plants. In particular, caragana actively fertilizes the soil it grows in by producing fixed nitrogen compounds that become available to other species (Shortt and Vamosi 2012). Not only did caragana preserve topsoil from erosion, it enriched it, fixing nitrogen and aiding in the growth of other surrounding plants. The deep roots and the fixed nitrogen of caragana helped it to facilitate the growth of a new forested riverine ecosystem, filled with balsam poplar (*Populus balsamifera)*, aspen poplar (*Populus tremula*), and white spruce (*Picea glauca*). The flourishing of this new ecosystem was so successful that by 1975, local residents began calling to protect the nature of Mill Creek Ravine as a local city park.

Table 6.1. Heavy metals measured in soils with high concentrations of burnt coal (clinker). Numbers in bold indicate that they exceed legal limits for remediation

Soil Samples with High Concentrations of Clinker	Cadmium (ppm*)	Antinomy (ppm*)	Beryllium (ppm*)	Lead (ppm*)
Sample #1	0.94	2.85	2.5	**218**
Sample #2	**1.85**	1.48	1.6	37.8
Sample #3	0.58	1.37	1.4	68.2
Average	1.12	1.9	1.8	**108.0**
Alberta Mean	0.37	0.3	0.5	9.0
Legal Limit for Remediation	1.4	20	5	70.0

*parts per million

Today, Mill Creek Ravine is one of the most popular parks in Edmonton, noted for its wild natural feel, despite remaining home to the most polluted creek in the province. Most of the industrial ruins are submerged under a century worth of soil, creek silt, roots, and shrubs. While still harmful to certain communities and species, the new ecology of Mill Creek Ravine has literally grown out of this waste. Archaeological excavation of Vogel's Meats revealed the ongoing entanglements of this industrial waste with the "natural" landscape. Excavations unearthed industrial waste as it slowly decayed in the soil, caught up in the "long process[es] of pulverizing, dissolving and rotting" (Douglas 2003, 160). This decay had left thick stratigraphic layers of mixed soils extending all across the site. In the garbage pile, dust from long disintegrated iron permeates a number of loosely packed soils, staining them bright orange. Spread across the northern section of the site, layers of pulverized concrete and brick lie ten to fifteen centimeters thick. Carpeting the whole site, piles of vitrified clinker slowly fragment beneath the grass.

Decaying bones ooze phosphorus into the soil, while disintegrating concrete alkalinizes the soil. Clinker leaches heavy metals into the soil and alters its pH. A third of all soils in the vicinity of the main packing plant building have a pH greater than 8.5, definitive of highly alkaline soils. Alkaline soils have a poor structure that impedes water infiltration into the soil and nutrient solubility (Peverill, Sparrow, and Reuter 1999). The lack of water infiltration limits the amount of available water for plants, as well as the bioavailability of soil nutrients such as magnesium, iron, copper, zinc, and manganese. In the soils with a high concentration of clinker, cadmium, antinomy, beryllium, and lead were measured at levels far exceeding the average concentration of soils in Alberta (Table 6.1). Both cadmium and lead were measured at levels that exceeded the legal limit for remediation.

Even in low concentrations, such elevated levels of heavy metals have direct effects on the local ecology. Lead in the soil can stunt growth and photosynthesis in plants and harm the nervous systems of animals living in the soil (Greene 1993). In particular, elevated levels of lead can harm the life cycles of microorganisms, slowing the breakdown of organic material and the production of new soils (Greene 1993). Similarly, elevated levels of cadmium in the soil can also be deadly for worms, limiting worm populations and, therefore, soil health (Hirano and Timae 2011). This combination of heavy metals limiting the number of worms and microbes, alongside high soil pH, broadly affects what types of plants and animals can live in it. Near the buried remains of the large packing building, the soil is thick and clayey, filled with rubble and clinker, with an average pH of 8 and elevated levels of cadmium, beryllium, lead, and antinomy. On the surface, the area is covered in small ruderal (weedy) plants that thrive in marginal and polluted soils: dandelion (*Taraxacum*), common plantain (*Plantago lanceolata*), and clover (*Trifolium repens*). Clover is a hardy plant that thrives in alkaline soils and helps to add nutrients like nitrogen to the soil. Dandelion is a ruderal plant species, meaning it thrives in disturbed or barren landscapes. Furthermore, due to its deep taproot, dandelions help to draw up nutrients from the otherwise nutrient poor soil and make them accessible to other plant species. Common plantain is especially good at thriving in soils with elevated levels of heavy metals (Gostin 2009; Przedpełska and Wierzbicka 2007; Szarek-Łukaszewska and Grodzińska 2011).

In the area around the old industrial waste pile at the Vogel's site, the soil has less concrete rubble in it and is considerably less alkaline than the soil near the packing house, with an average pH of 7.2. Larger trees and shrubs grow out of this soil, hugging the banks of the creek. Plants growing here are more suited to acidic soils: *Caragana arborescens*, balsam poplar (*Populus balsamifera)*, aspen poplar

(*Populus tremula*), and white spruce (*Picea glauca*). This covering is most dense to the north and to the south. To the east, where the garbage pile is the densest, the area has few trees but is instead covered in understory, consisting of wild rose (*Rosa acicularis*), dogwood (*Cornus sanguinea*), horsetail (*Equisetum arvense*), and some long grass. Wild rose and horsetail prefer acidic soils, and white spruce in particular requires neutral or acidic soil to grow. Both horsetail and dogwood are common riparian plants; their presence suggests soil with good water infiltration. Root systems like those of aspen, caragana, and wild rose create well-connected channels underground, facilitating the movement of moisture and making water and nutrients available for more plants.

This thick tree-stand of caragana and spruce provide nesting grounds for birds, voles, and squirrels, as well as privacy for humans. Hidden in the thick tree stand, a homeless camp was once located right on top of the buried bones of the garbage pit. Along with evidence of an old tent and some magazines, an old shopping cart was left rusting half filled with soggy books and glass bottles. On one hand this old camp, shopping cart, and wet disintegrating books point to the vulnerability of life lived rough in the ravine on top of a soil that is still filled with toxins. On the other hand, they point to the affordances of the plants that grow out of the remains of early industry. Thriving in toxic soil, this ecology of hardy ruderal plants provides spaces of privacy. Disintegrating, rusting, and breaking, these objects also begin to decay in place, slowly merging into the waiting ecology that surrounds them.

Pushed out of downtown by the increasing privatization of public space in Edmonton, the homeless population now build campsites in a "natural" landscape filled with hidden and decaying industrial waste. There is a recursive historical logic to these campsites. A century after the shantytown of Ross Acreage was established, the same area is now used as a campsite by a new community of marginalized and vulnerable individuals. During the Great Depression, the boom-and-bust cycle of capitalism forced the destitute families of Ross Acreage to live rough off of a toxic landscape. Today, the pressures of neoliberal privatization have forced homeless people to live in the same landscape, a landscape still filled with the same decomposing, but lively, remains. In both cases, the exploitive force of capital articulates with the uneven harms that emerge out of the decaying afterlives of industrial waste. The entangled relations of this afterlife do not just provide new harms, but also possibilities (for other discussions of marginalized communities making place in marginal spaces in this volume, see Danis [2022] Chapter 7 and Wilkinson [2022] Chapter 5). While once the decaying remains of industry served as a place for salvage, they now serve as the fertilizer for new plants that provide privacy and shelter.

Conclusion

Industrial production did not end in Mill Creek Ravine when the meatpacking plants and coal mines abandoned the ravine, it continued to mediate the production and reproduction of the (post)industrial landscape through the waste and ruins it left behind. However, the long-term legacies of industrial waste are neither straightforwardly beneficial nor harmful. Since its deposition, the industrial waste of Mill Creek Ravine transformed from useless waste into a vital resource that helped the community of Ross Acreage survive, a harmful toxin that inhibited their struggle for survival, and a fertilizing nutrient that has facilitated the growth of certain plants and animals, while inhibiting others and changing the local ecosystem. Tracking the ecological life of abandoned industrial waste, the series of entangled relations it moved in and out of as it decayed, reveals the complexity of the relations that define the Anthropocene. Focusing on the history of Mill Creek Ravine through the multispecies relations that congeal around industrial waste reveals many of the horrors of life in (post)industrial landscapes: the pressures of poverty that force whole communities to sacrifice health for immediate survival and the long afterlives of toxic capitalist waste. At the same time, this trajectory also reveals histories of resilience and ingenuity, histories of salvage, strange symbiotic relations between stranger bedfellows.

Shannon Dawdy writes that "there is hope in ruins" because they represent cracks in the façade of modernity through which "new social forms can emerge" (2010, 777). I would argue that these are not just the cracks for new social relations, but ecological ones. Acknowledging that the Anthropocene is inherently tied to the practice of capitalism, this critical focus on the "old places" of industrial production is also essential to understanding life after the Anthropocene. Abandoned by capital, landscapes of industrial ruins and industrial waste serve as the fecund yet toxic sites from which new combinations of people, plants, and social relations emerge out of the contradictions of capitalist exploitation. Growing in landscapes where capitalist fantasies have come and gone, these marginal communities develop in the shadow of capital but live largely undetermined by the drive for capitalist accumulation and surplus value. As such, these ecologies provide a glimpse of lives lived otherwise, focused not on labor, exploitation, and the accumulation of commodities, but instead on salvage, subsistence, and toxic exposure. In order to understand the particularities of the history of the Anthropocene as a historical era, we have to attend more closely to the particular forms of life and the tactics of survival that emerge in the ruined remains of a (post)industrial capitalist landscape. The relations and strategies exhibited by caragana and the community of Ross Acreage serve as the sprouts for life that is resilient in the face of the toxic aftereffects of capitalist destruction. As such it represents a gesture towards life and society in not just a postindustrial landscape, but a post-Anthropocene world.

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