

WASTE, LANDFILLS, AND AN ENVIRONMENTAL ETHIC OF VULNERABILITY

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Western landfills are sites of forgetting made possible through legislative decision, regulative decree, risk models, community accession, and engineering practice. Despite this forgetting, waste doesn't really go away—it flows over time and through space. This paper considers landfills as living natural flows where multitudes of bacteria collaborate with human debris and geological forces in creating assemblages of known, unknown, and unknowable entities. Through an exploration of leachate—putrescible and organic landfill material transported by water—I suggest geo-bacterial processes across strata necessitates an environmental ethic of vulnerability, sensitive to human and nonhuman asymmetrical vulnerability to an unknowable future, and focused on remembering and bearing witness to the waste we want to forget.

Canada is the world's highest per capita municipal solid waste producer. By 2000, Canadians produced more annual waste per person than Americans; and by 2005, Canada produced nearly twice as much garbage as Japan (Conference Board of Canada 2008). By 2006, Canadians produced over 1000 kg of waste per person; 35 million tons of waste in a single calendar year (Statistics Canada 2008). The bulk of this waste ended up in landfills (*ibid*). In 2010, thirty percent of existing Canadian landfills reached or surpassed capacity. Over one million tons of waste

were exported out of Canada in 2002, much of it headed from southern Ontario to rural regions of Canada or to the United States (Statistics Canada 2005). Some cities have settled on new landfill locations, and in some cases invested in construction, only to discover both significant public opposition and problems in risk and impact assessment.

Worldwide, landfills are a prism through which social scientists refract the politics and economics of consumption; intergovernmental, industry-government and labor relations; urban-rural divides; health; gender and waste economies; science-public relations; risk; governance; and more (Maclaren and Thi Thu 2003). Landfills, these analyses suggest, tell us a great deal about ourselves, and our relations within communities, with the environment, and with global society.

Waste, landfill's necessary precursor, is invested with a diversity of meanings, from lost work time, incomplete production and so on (Gille 2010). Yet despite its ubiquity, writes Wynne, "waste exist[s] in the twilight zone where no clear, 'natural' definition of [it] can be given, within wide margins of uncertainty and variation" (1987, 1). Like other contemporary environmental concerns, waste is associated with excess, and "coping with excess is what passes in late-modern society for individual freedom" (Bauman 2001, 90). Modern capitalism defines waste entirely within economic terms as "simply resources out of place", and concentrates on transforming it from the material detritus of industrialization into further economic potential. Waste management practices such as recycling further shift attention from "industry and production to households and consumption" (Hawkins 2006, 104; Kolikkathara, Feng, and Stern 2009).

Waste is a monument to all that we once wanted and now do not want, once valued and no longer value. Waste is an ironic testimony to a desire to forget. Landfills, in other words, make their appearance on and in the landscape as a material enactment of forgetting. As Hawkins observes, the landfill is a:

...world of soaring garbage, mountains and valleys, trucks and roads with its own distinct smell and soundscape; a place that organizes and frames things *as* waste. A place where "all the appetites and hankering, the sodden second thoughts came runneling out, the things you ardently wanted and then did not." The open landfill is a landscape in its own right, a "dump" where we confront the forceful presence of things just sinking into themselves, broken and decaying no longer bound by taxonomy or value. (2006, 71)

I am interested in landfills as ubiquitous places of forgetting, the presumed end point to the garbage we diligently put on sidewalks to be taken away to dumping stations and then to the countryside and other countries for burial out of sight, and mainly, out of mind. This forgetting is made possible through legislative decision, regulative decree, risk models, community accession, and engineering practice. Landfills are a site where “natural processes and human interactions are jumbled together in complex and widely variable ways, making a badly structured and, indeed, indeterminate behavioral-technical risk-generating system” (Wynne 1987, 1). Forgetting and environmental ethics, I will suggest, conjoin in these mundane sites that occupy ever-increasing geographies of space and time.

Waste, of course, doesn’t really go away. Waste flows (Gille 2006). Landfills are not only an archive to all our sated desire; they are “an accumulation of the past that is very much alive in the present” (Van Wyck 2012). Metaphorically alive, to be sure, but much more than this. Waste, as Gregson and Crang remind us, “is a long ways from stuff that ‘just is’... rather it becomes” (2010, 1028). I want to attend to landfills as living natural flows, where multitudes of bacteria collaborate with human debris and geological forces in creating entities, some of which we know need managing, and other entities—contaminants of emerging concern—that have yet to be identified, and whose management is therefore virtual. While this is a story of relational materiality – a gathering if you will – it is not one of co-enactment whereby humans ultimately (and triumphantly) manage or determine processes and outcomes. Landfills, I will argue, bring to the fore the asymmetric relationship between geo-bacterial liveliness and humans, suggesting an environmental ethics of vulnerability in which humans are vulnerable to living and nonliving earth processes (for an extended discussion see Hird 2012 and Clark and Hird, forthcoming). This vulnerability, in turn, calls for a *heightened*, not diminished, assumption of responsibility. Responsibility extends not simply from curbside garbage to landfill, but to the unknown and unanticipated; a future environmental ethics that depends upon remembering what we have forgotten. An environmental ethics concerned not only with past and present damage but also with future unknowable vulnerability to harm (van Wyck forthcoming).

The science and engineering of landfills is all about making sure waste doesn’t leak. Leachate—putrescible and organic material transported by water—does just this: it leaks. Leachate moves between geological strata;

containment and disposal; between space and time. As it moves, leachate disperses known, unknown, and unknowable entities. Some of these entities we know to be harmful, some will cause harm that will only be recognized as such at some undefined point in the future, and some will emerge as concerns in an unknown future.

To bring this environmental ethics into view we must, says van Wyck, somehow figure out a way to “bring into memory, and thus bear witness to events which we don’t want to remember, nor...be remembered for” (forthcoming). This paper explores how we might think about landfilling as an environmental ethical concern that brings buried and forgotten waste to the surface of our ethical landscape.

TECHNOSCIENCE, GEOSCIENCE, AND RADICAL ASYMMETRY

Eco-feminism forefronts analyses of the western ontological separation of nature from culture. These explorations span a wide gamut of materialities: baboons, microscopes, neutrinos, death, fire, and feet prove ill characterized as either nature or culture, but rather suggest a complex and situated entanglement (Barad 2007). Much of this effort stimulates re-engagement with the ontological relationship between humans, and the organic and inorganic.

Within science and technology studies, Actor Network Theory provides perhaps the most developed theory challenging the Kantian ontology separating humans from the universe, words from action, and an epistemology separating thought from being (for a detailed discussion see Hird 2011). Latour’s “principle of generalized symmetry” requires that analyses consider myriad nonhumans as well as human relations (1993, 103). These nonhuman “missing masses” enroll in assemblages, and are defined by their strength of resistance to other entities (Latour 1992, 225). On occasion, these assemblages stabilize into networks, which afford opportunities for action that evade any single entity’s own operations. As an analytic, assemblages and networks widen the allowable possibilities for relating, and replace humanity’s exclusive dominion with a “parliament of things” (Latour 1993, 142). As Puig de la Bellascasa points out, “humans are not the only ones caring *for* the Earth and its beings—we are *in* relations of mutual care” (2010, 164).

The focus on relational materialities resonates within feminist theory, as one of its signature goals remains to divest western philosophy of the

fallacy of humanity's intractable autonomy. Long expert in disabusing (his)tory's narration of man's autonomy from women, home, nature, emotion, and irrationality, feminist science studies scholars attend to world-making through material technoscientific entanglements (Haraway 2007). A significant task here is to name the entities that compose a network; those differential forces that make up, stabilize, and move between strata, subtending further elements in new encounters.

Conceptualizing world-making as the co-enactment of human and nonhuman relations reveals instead the myriad relations upon which all life intimately depends. At the same time, however, we are challenged in our analyses to consider relations between nonhumans that do not somehow, at some time, also involve humans, and Latour's own writing has been criticized on this count (Harman 2009, Doing 2008, Clark 2010). By tending towards analyses that always involve humans, we forestall analyses of entities that exist prior to our encounter with them, and between nonhuman entities that do not involve or engage humans.

This point brings to the fore a critical difference between geo- and techno-sciences. Technoscience is, by definition, concerned with knowledge-building through relations between humans and nonhumans in historical, political, economic, and social context. Humans, in other words, are central to technoscientific co-enactments: GM foods, stem cell research, artificial life, reproductive technologies, and global warming so-called fixes all involve encounters between humans and nonhumans that entrain new entities and politics via laboratory and field encounters. Technoscience, in other words, brings to the fore current practices and imagined futures in which humans make up the world through the manipulation and management of nonhuman entities (Clark 2010).

Geoscience, on the other hand, must take as its starting point the liveliness of inorganic and organic processes long before the evolution of humans and other animals. Geoscience explores a cosmos where inorganic precedes organic, and billions year-old Earth processes establish life quickly, proliferate, differentiate, and engage with living and nonliving entities alike. Bacteria are central to these Earth processes, participating in the most enduring networks, establishing and sustaining the biosphere. They are, in an Actor Network Theory sense, the most robust of entities. Our last universal common ancestor, bacteria created all major forms of metabolism, multicellularity, nanotechnology, metallurgy, sensory and lo-

comotive apparatuses, reproductive strategies and community organization, light detection, alcohol, gas and mineral conversion, hypersex, and death. Far from autonomous entities, humans—like all other animals—are a rag-tag assemblage of largely bacterial entities in constant flow, or as Ingold puts it, “it is not...that things are entangled in relations; rather every thing is itself an entanglement” (Ingold 2007, 35; Hird 2009). But further than this, bacteria remind us that most relational encounters on earth have nothing to do with humans; nor are humans even aware of most of these encounters and assemblages (Hird 2009).

Geoscience excels in recognizing what Clark and others refer to as the “radical asymmetry” of relations between humans and the vast expanse of nonhuman entities that created and continue to sustain the earth (2011, 48). Geoscience comes to the fore in research on the creation of the Earth’s continents through bacterial proliferation and networking. For instance, Schwarzmann and Volk (1991) have shown that microbes facilitate rock weathering by as much as one thousand times. Lowman and Armstrong’s research on plate tectonics suggests that while the earth’s major concentric layers—the liquid core, the convecting mantle and the outer crust—were formed by the same kinds of processes found on other (silicate-rich) planets:

the broad aspects of the Earth’s geology as it is now—continents, ocean basins, the oceans themselves, sea floor spreading and related processes—are the product of fundamentally biogenic processes, acting on a crustal dichotomy formed by several enormous impacts on the primordial Earth. The fundamental structure of the Earth, not just its exterior and outer layers, thus appears to have been dominated by water-dependent—and thus life-dependent—plate tectonic processes (2002, 279).

Volk’s research on cycling ratios describes the biosphere as a “wasteland world” in which one organism’s waste is another’s treasure, to be used as food or other resources (oxygen, for instance, is plant and bacterial waste). Volk writes:

[The Earth is] one big wasteworld.... Regarding the atmosphere’s CO₂, more than 99 percent of the entire reservoir has recently been ejected by a living respirer rather than a volcano. For nitrogen, more than 99 percent has been discharged from living denitrifiers rather than volcanoes. And for methane and many other trace gases, more

than 99 percent has been expelled from living prokaryotes rather than volcanoes. The atmosphere is one giant waste dump (2004, 31).

What techno- and geo-sciences share is a keen acknowledgement of the potential for lively encounters between entities to *not* proceed according to (human) design or plan. As Clark puts it, “there are pressing issues in which what is most alarming is life’s very exuberance; its unregenerate capacity to multiply, transform and mobilize itself, its proclivity to turn up in forms we didn’t anticipate, at sites we don’t want it, in numbers we can’t deal with” (2010, 27). So it is not so much that geo-science far better appreciates the way the geo-bio tends towards superabundance. What differentiates these approaches is their emphasis on co-enactment, or what forces operate in these proliferations, new life forms, and potentialities. Within technoscience, the emphasis is on how humans interact with non-human entities, whether this be Pasteur and his human collaborators who enroll bacteria in assemblages through bio-power beyond the petri dish such that “after 1864 airborne germs were there all along,” or the ways in which scientists and engineers are enrolling bacteria in bioremediation to treat forms of waste (Latour 1988, 173). The accent here is on those present and future processes in which humans may direct the geo-bio flow in intentional and determinate ways. But landfills, I suggest, beg much deeper consideration of geo-bio processes that are unsolvable by human regulatory policies and diversion practices.

LANDFILLING AND LEACHATE

Around the globe, up to 95 percent of all waste is dumped in landfills (Kim and Owens 2010). Due to the sheer quantity of waste being dumped, landfills may only be operational (in the sense of remaining open for continued dumping) for twenty years. Landfills consume a vast amount of energy: all the energy used to sort, treat and recycle waste is insignificant compared to the energy (in the form of diesel fuel, electricity, petrol, bunker oil and natural gas) used to transport waste to landfills (Chong and Hermreck 2010).

Landfills vary significantly in design, capacity, content, and after care. In developed countries, for instance, landfills are lined with a complex layering of rocks, sand, and geo-textile membranes and/or liners. In developing countries, landfills are often unlined and accept unsorted hazardous and nonhazardous waste alike. In Canada, landfills consist of any

number of waste cell layers. These cells are placed on top of each other to form waste columns; and landfills consist of any number of columns (Yildiz and Rowe 2004). And while conceptual models, constructed to test landfill quality, assume each layer is a completely mixed reactor with uniformly distributed waste, moisture, gases and bacteria—this is not the case, with cells containing decomposed material of varying degrees (*ibid*). Many factors need to be taken into account in terms of estimating landfill settlement: “type of waste, moisture content, compaction density, porosity, compressibility, biodegradation rate (level of nutrients available for biological activities, presence of enzymes, sludge addition, pH, temperature), and mode of landfill operation” does not exhaust the list (Elabroudy et.al. 2008).

Studying landfills is in a geo-bio sense a way of understanding the social life of a wide diversity of things. As Parsons reminds us, an object spends little time within the realm of human production and consumption, which is but “one moment in the wider life of a thing” (2008, 392). Municipal landfills contain the expected—diapers, metals, plastics, Styrofoam, wood, liquids, refrigerators, pet shit and litter (as well as the dead pets themselves), batteries, food, chairs, fabrics, and so on—and the rather less expected, such as products of common industrial processes like coal fly ash, of which over 50 percent ends up landfilled (Chertow 2009). More than 308 million tons of plastics are consumed worldwide each year, and despite heavy campaigns in some areas, most plastic ends up landfilled (PlasticsEurope 2009). Over 97 percent of food waste is landfilled in the United States (Levis et al. 2010). Landfills also mix waste designated hazardous with that defined as non-hazardous. While hazardous industrial waste is typically differentiated from municipal solid waste on the basis that it is generated from different sources, Wynne argues:

“Hazardous” waste should strictly include municipal, household waste, because the toxicity of many domestic wastes—batteries, cleaning and polishing fluids, cosmetics, medicines, etc.—is higher than that of some industrial wastes. The toxicity of some leachates from municipal landfills is at least as high as that from controlled, “hazardous” waste landfills. The greatest source of environmental cadmium is thought to be from batteries thrown out in domestic waste. Municipal waste incinerators are also known to emit dioxins with their aerial discharges, possibly to worse levels than toxic waste incinerators. Yet municipal waste is excluded, not for technical risk, but pragmatic reasons (1987, 46).

This is what we put into the ground. Once there, these materials become part of the production and consumption economy of bacteria. In other words, these myriad heterogeneous materials leave the production economy involving humans (bacteria and other entities are already an indelible part of this economy of course), and enter a nonhuman domain. Landfill bacteria are abundant and heterogeneous, their “variations may be cyclical, directional, stochastic, or chaotic” (Collins, Micheli, and Hartt 2000). The bacteria metabolizing objects in their early landfilled life are mainly aerobic. Acetogenic biodegradation under aerobic conditions produces material that is highly acidic and toxic to surface water. Deeper in the landfill, mainly anaerobic bacteria do the bulk of the metabolizing work, producing leachate. Leachate is itself a heterogeneous mix of heavy metals, endocrine disrupting chemicals, phthalates, herbicides, pesticides, and various gases including methane, carbon dioxide, carbon monoxide, hydrogen, oxygen, nitrogen, and hydrogen sulphide. Bear in mind there are over seven million known chemicals, 80,000 of which are in commercial circulation, and with about 1000 new chemicals entering into commercial use each year (Wynne 1987, 48). Add to this the approximately 14,000 food additives and contaminants added to landfills when we put food in our garbage. Major concerns include myriad adverse health effects for flora and fauna from soil and groundwater contamination, gas emissions, and so on. For instance, ninety percent of greenhouse gas emissions from the waste sector consist of methane emitted from landfills and wastewater. This accounts for about three percent of total greenhouse gas emissions (Chertow 2009).

Factors affecting leachate production rate and composition include the

characteristics of the waste (initial composition, particle size, density and so on), the interaction between the percolating landfill moisture and the waste, the hydrology and climate of the site, the landfill design and the operational variables, microbial processes taking place during the stabilization of the waste, and the stage of the landfill stabilization. Most of these factors change during the operational period of the landfill as the landfill is developed causing significant changes in leachate quality and quantity. (Yildiz and Rowe 2004, 78)

Landfills are a particularly vigorous assemblage: bacteria relentlessly metabolize matter into leachate, which in turn percolates into soil and groundwater, where it moves into and through plants, trees, animals,

fungi, insects, and the atmosphere. Leachate assembles geo-bio networks: it travels vertically and horizontally within landfills, and continues to travel when it leaks beyond landfill cells. The longevity of landfills means leachate also travels through geological strata.

Via leachate, bacteria create well known, little known, and new social forms. Concrete practices of diligently picking up our dogs' poo with plastic bags and then putting this assemblage into an already percolating trash to end up in further combinations and potentialities with leachate—a classic meditation on modernity if there ever was one—produces, amongst other things, coliforms, which produce further assemblages of diarrhea, immunological response, labor slowdowns, health crises, policy revisions, media reporting, government discourse, mutation, and so on (Mor et.al. 2006). As Ingold reminds us, “wherever life is going on, they are relentlessly on the move—flowing, scraping, mixing and mutating. The existence of all living organisms is caught up in this ceaseless respiratory and metabolic interchange between their bodily substances and the fluxes of the medium” (2007, 13).

AN ENVIRONMENTAL ETHIC OF VULNERABILITY

The problem with landfills is that their containment is always potentially temporary; eventually they may spill and leak. Engineers design, model, and test complex technologies for leachate containment, and then describe the consequences of landfill corruption and failure. If all of the world's laboratories tested chemical toxicity, only about 500 of the over seven million chemicals known to exist could be tested *per year* (Wynne 1987, 48). Successful landfill design and aftercare, in engineering terms, extends to perhaps one hundred years, a mere moment in geological and bacterial time. So failure is there from the start (Virilio 1993). Waste never leaves; it is never fully contained or controlled. We know little of what waste is made of in any given landfill, or with what future landfills will be composed. Waste moves through geologic strata, creating forms already known to be harmful, and forms yet unknown. This geo-bio assemblage enrolls technology, production, consumption, excess, metabolism, climate, forgetting, and environmental ethics.

The question, as Puig de la Bellacasa astutely asks, is “how do we engage with accountable forms of ethico-political caring that respond to alterity without nurturing purist separations between humans and non-

humans?” (2010, 159) This question resonates within the vulnerability literature concerned with issues of social justice, responsibility, and ethics within a global environmental context. As an early contributor to these issues, Robert Goodin (1986) argued it is the vulnerability of others that generates responsibilities towards them as opposed to a person’s intimacy or familiarity with their benefactors. Responsibility, in other words, is generated by the vulnerability of others to our actions and choices, however direct or indirect (1986, xi). An ethics of vulnerability draws our attention to the extended others—human and nonhuman—affected by our actions in such dramatic events as floods and nuclear disasters, and in longer-fuse changes such as global heating and ground water, and soil and air contamination via landfill leachate. A growing literature focuses on the disproportionate vulnerability of certain groups—women, children, poor, endangered species, and others—to ongoing and emerging environmental concerns as a matter of social justice (see for example, Adeola 2012; Bullard 2000; Cutter 1996; Davis 2002; Foote and Mazzolini 2012; Hossay 2006; Klinenberg 2003; Margai 2010; Sandler and Pezzullo 2007; Turner et al. 2003). This literature also draws our attention to the corollary; that we are vulnerable to the actions of an extended range of human and non-human others.

Centering geo-bacterial relations in formulations of the human-Other does more than expand the universe of things we must take account of. It asks us to consider ourselves as vulnerable to, and with, our environment as latecomers to life’s already long-established flourishing and failing within a volatile landscape (Hird 2010). As new arrivals on the scene, an environmental ethics of vulnerability means we neither created nor chose our original entanglements (Dixon 1994). This ethics reminds us that nature relentlessly flows, but not in ways that are necessarily compatible with human flourishing.

Environmental ethics further points out the limits of assuming that, “through rational action, human and social intentions are fully realizable and nature, human bodies, and materials can be molded to our liking given the right science and technology” (Gille 2010, 1054). Recognizing processes that both stabilize and spawn new entities in relentless evolution troubles sustainability arguments that nature may be managed in ways that correspond with current levels of object consumption and disposal (Lynas 2012).

Gregson and Crang (2010) point out that most social scientific work on waste focuses on its management, which quickly segues to discussions of treatment technologies. For instance, alongside the already well-analyzed problems with waste-as-resource discourse, we might add increasing interest in much-touted forms of bioremediation. Bioreactors and incineration rehearse conventional discourses of waste as resource, as well as suppositions of human control. Environmental groups' concern with the consequences of incineration as well as the recycling of particular forms of waste into such things are paving gravel calls attention to the unknown, and long-term unknowable, consequences of such technological responses. Phytoremediation is another attempt to deal with leachate through landfill aftercare. In a process whereby certain tree species are planted on closed landfills, the tree roots ingest leachate, and expire a more environmentally palatable form into the atmosphere. This process is considered successful if the trees are not asphyxiated and survive up to two years after siting.

Concentrating on bioremediation, and waste management technologies more generally, may actually foster our current relentless forgetting, or worse, inexperience with waste beyond feel-good practices of recycling, composting, and curbside disposal. We cannot, as van Wyck reminds us, bear witness to something we have forgotten: "How do we constitute in memory something that was not fully experienced to begin with?" (2012). Commenting on memory and forgetting, Baudrillard (1996) recalls the familiar childhood hide-and-seek game. You never want to make yourself too invisible, he says, or others will forget about you. And in both human and geo-bio deep time, forgetting has consequences.

REMEMBERING AS ONTOLOGY

If western landfilling depends upon a kind of forgetting, then an "Aboriginal cosmopolitanism" is about remembering (Clark 2008). Clark draws our attention to a kind of remembering that proceeds from a different being in the world. When a people have lived for millennia in the same place, experience is all about paying attention to landscape variability. "Staying in one place," Clark argues "means to travel adventurously" (2008, 4). This is what McGregor means when she makes the point that traditional environmental knowledge "implies that the knowledge is static and confined to information gained in the past. In reality, this form of knowledge is continually evolving and expanding to incorporate new

information as part of adapting and responding to current challenges” (McGregor 2009, 73).

Generations of colonizing explorers and settlers remarked upon Australian Aboriginal peoples’ use of fire to contain fire. A strange reaction to a strange landscape, what settlers eventually discovered through their own dealings with this dynamic environment was that “going with the flow”—working with fire rather than against it—resulted in more flourishing (ibid; see also Frankllin 2008).

Experience—going with the flow—is about remembering and adapting. Connecting with the environment, in other words, requires remembering the experiences and sensations of others. Some indigenous cosmology includes in this experience nonhuman animals as well as the inorganic—weather, climate, mountains and valleys, rivers and lakes—remembering (Assembly of First Nations 1993; Atleo 2004; Cajete 2000). This sense of remembering calls an unknowable future into the present. Remembering, in this sense, is as much about the future as it is about the past.

It is this mode of remembering that provides an account of the Australian Aborigine way of leaving waste as it is created, on the landscape, in plain view. These acts, across generations, strike western settlers as the antithesis of civilization, where all waste must be scrupulously moved away from people and their communities as one of civilization’s key *conditions* (Freud 2010). For Aborigines, argues Bird Rose (2003, 2004), this casting away from oneself and burying waste, this out-of-sight-out-of mind, amounts to “self-erasure,” the performance of a lie, a refusal to witness, “the equivalent of sneaking around the country.” She writes:

The remains of people’s action in country tell an implicit story of knowledgeable action: these people knew where they were, they knew how to get the food that is there in the country. The country responded to their presence by providing for them, and the remains are evidence of the reciprocity between country and people. In contrast, my teachers held self-erasure to be the equivalent of sneaking around the country. Antisocial people who do not announce themselves, and use special techniques to avoid leaving tracks or traces, are up to no good. These are people who intend harm and who have something to hide. Stories about them are well known, and the evidence of their activity, in the form of illness or death, is all around one. But the actual signs of their presence are invisible; self-erasure is part of their harmful art. (2003, 62)

In Canada, we find another mode of remembering waste. In the 1930s and 1940s, the Sahtú Dene were employed by the Eldorado Gold Mines corporation to mine uranium ore without knowing of its effect on their health and their environment (tons of radium tailings dumped into the lake, and many kilometers of ground), living generations later with its after effects: depression, addiction, cancers, mutating and dying flora and fauna. The uranium made its way along what van Wyck (2010) calls the *Highway of the Atom*, up from the mine on the shores of Great Bear Lake, over land to Port Hope and then to the United States and the Manhattan Project, where it was eventually dropped on Hiroshima and Nagasaki during World War II. Not until the mid-1990s did the Dene become conversant with what had happened.

“How”, asks van Wyck, “do we constitute in memory something that was not fully experienced to begin with?” (2012). In a remarkable act of remembering a trauma they did not experience as such, and a cascade of deliberations, decisions and actions they were unaware of, the Dene claimed responsibility for a waste they did not entirely produce, control, or even understand as waste. In 1998, a group of Dene travelled to Japan and apologized to the Japanese people for the catastrophic destruction caused by the atomic bombs.

What can we make of the Aboriginal Australian and Canadian senses of responsibility? In the Dene’s case, it is responsibility accepted for consequences severed from actions, not through forgetting or denying, but through unknowing. This is a different mode of environmental ethics that, as Smith points out, “appears unbidden even before the possibility of self-reflection and deliberate self-interest emerges” (2011, xii). This, I argue, is an environmental ethics of human vulnerability to the unpredictable volatility of geo-bio processes in deep time. A vulnerability that requires unremitting visibility and remembering, and enables a form of responsibility to human and nonhuman alike.

CONCLUSION

The idea that we could return to some sort of primordial state (a state of zero garbage) is a well-rehearsed theological theme. Zero waste is neither a possibility nor necessarily an appropriate aspiration. Waste, after all, as Volk reminds us, fuels the world’s metabolism. Animals breathe oxygen expired by trees and converted by bacteria. This is not to say the solution—if there is only one—is to sustain our business-as-usual ap-

proach. The point is that we need landfill no further, and the problem of what has already been landfilled remains. Nor do we necessarily want to excavate existing landfills—if we even knew what to do with this past waste—because this creates its own issues of further disturbing leaching processes, and bringing more leachate to the surface.

A political, economic, and cultural society dependent upon consumerism, and a stewardship approach to environmental issues ensures that landfilling, and waste management more generally, continues to be framed largely in terms of technological innovation, jurisdictions, and diversion practices produced through education, surveillance, sanction and censure (Lynas 2012). In a very real sense, “we are condemned to manage our wastes technologically.”¹

In *The Tragedy of the Commons*, Hardin (1968) famously identifies several problems for which there are no technological solutions, including the nuclear arms race, population increase, and pollution. Hardin’s metaphor is based on the rationality of each person seeking to maximize her or his own gain. We are to imagine a pasture, which constitutes a common ground where herdspeople graze their sheep. Each person, acting in their own best interests to increase their profit, adds another sheep to their flock. Eventually, the commons is over-grazed, with deleterious consequences for all. The tragedy, then, is that ruin is ensured by each person’s pursuing her or his own best interest “in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all” through a “collective conspiracy of forgetting” (ibid, 1244).

Landfilling, and our waste management institutions and practices more generally, might be viewed as a tragedy of the commons. Each government sites landfills discriminately on the basis of minimizing costs to its taxpayers and certain kinds of protest, and other political-economic considerations (Wynne 2012). This paper argues landfilling requires ethical as well as technological innovation. With Hardin, I agree the land is not a commons, and it is certainly the case that solutions are increasingly dependent upon coercive measures defined as responsible citizenship. However, a politics organized around private ownership and sovereignty allows land to be understood as a resource to be used, and does not alleviate the tragedy. Moreover, as Ostrom et al. (1999) argue, evidence suggests local—we might read Aboriginal—inhabitants have often solved communal resource issues via long-standing sanctions and practices. The tragedy occurs when this hitherto common ground is confiscated and taken over

by nonlocals (Ambler 1991). If the commons renders visible, then landfills disavow, externalize, and abject (Ostrom et al. 1999). Our current western approach largely defines the ethics of waste as an issue of *domestication*. That is, society continues to charge engineers and scientists—those few people whose job it is to remember waste—with the task of increasing the scope and quality of landfill containment, and identifying the toxicity of their inevitable expression.

So long as landfilling depends upon the presumption of a world that can be contained and controlled by human forces, solutions will remain concerned with management alone. It is only by thinking about landfilling as both a technological *and* ethical concern that we might begin to address our vulnerability to earth processes as something more than a technoscientific problem (Clark 2012; Nancy 2000). “It is,” Smith reminds us, “our attending to the (in)different realities of the natural world that opens up the possibility of any ethics at all” (2011, 50). In this way, technological responses would occur within an overarching environmental ethics. We might well look to Aboriginal cosmologies that consider the human-nonhuman less in terms of categorical distinction and more in terms of shared being, and our relations with the earth in terms of hard-won responsiveness and working-with that an environmental ethics of landfilling may emerge.

NOTES

- 1 I thank an anonymous reviewer of this paper for this powerful quote.

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