1 · Land, Nature, Resource, Property

Permission to Pollute

According to Canadian federal regulations, 0.010 milligrams (mg) of arsenic per litre (L) of drinking water is acceptable, but 0.011 mg/L is too much.[1] The maximum acceptable concentration for lead in tap water is 0.005 mg/L.[2] Under the permission-to-pollute system, specific quantities of contaminants are allowed legally in bodies of water, human bodies, air, food, and environments. This way of governing pollution is relatively new, but it is premised on an old colonial system of land relations where the land is a Resource.[3]

A core scientific achievement in the permission-to-pollute system was the articulation of *assimilative capacity*—the theory that environments can handle a specific amount of contaminant before harm occurs. Today, assimilative capacity is a term of art in both environmental science and state regulation. It refers to "the amount of waste material that may be discharged into a receiving water without causing deleterious ecological effects."[4] Measures of assimilative capacity compare the rate of metabolism with the rate of pollution, with assimilative

1 Health Canada, "Guidelines for Canadian Drinking Water Quality."

2 Health Canada, "Lead in Drinking Water."

3 This argument was first articulated in a pamphlet titled "Pollution Is Colonialism" created by my lab and another group I'm part of, and it relies heavily on my and Michelle Murphy's work. See CLEAR and EDAction, "Pollution Is Colonialism"; and Shadaan and Murphy, "EDCs as Industrial and Colonial Structures."

4 Novotny and Krenkel, "Waste Assimilative Capacity Model for a Shallow, Turbulent Stream," 604.

capacity marking the place where the two are equal. This is the threshold of harm. The threshold theory of pollution differentiates between *contamination*, as the mere presence of a pollutant, and *pollution*, as the manifestation of (scientifically!) demonstrable harm by pollutants when metabolism is overwhelmed.

Assimilative capacity is based on land relations that strip away the complexities of Land[5]—including relations to fish, spirits, humans, water, and other entities—in favour of elements relevant to settler and colonial goals for using the water as a sink, a site of storage for waste.[6] As la paperson (diaspora settler of colour)[7] has written, "Primitive accumulation involves not only the gathering of 'natural' resources as assets but also the externalizing of the 'cost' of the accumulation in the form of contaminated water, disease, and other traumas to the 'natural,' nonpropertied, that is, 'Indigenous,' world. To be subject to anti-Indian technologies does not require you to be an Indigenous person."[8] Sinks are one such "anti-Indian," colonial technology.

Assimilation theory transforms bodies of water and other environments into a Resource for waste disposal. As I will argue in this chapter and throughout the book, this kind of environmental science is premised on access to Land for settler and colonial goals (in this case, waste disposal). Through dominant science[9] and other methods, these land relations come to seem true, good, and natural.

This and subsequent chapters are structured so that theoretical and historical arguments are interspersed with memories and stories from CLEAR lab members. Some of these stories are mine, but most aren't. They are designed to clarify and expand on ideas but also to show that science, colonial or anticolonial, is not monolithic and points of friction and opportunities for doing science otherwise present themselves regularly. All stories are shared with permission.

5 See footnote 19 in the introduction for why *land* is sometimes capitalized and sometimes not.

6 A sink is a land-based place to store waste. In the words of historian Joel Tarr (unmarked), "Much of the history of industrial waste disposal, as well as the disposal of wastes from other sources such as an urban population, involves the search for a 'sink' in which wastes could be disposed of in the cheapest and most convenient manner possible." Tarr, "Searching for a 'Sink,'" 9.

7 See footnote 10 in the introduction for why some authors are (unmarked) and others are (diaspora settlers of colour).

8 paperson, *A Third University Is Possible*, 11. For readers who might be new to how Indigenous theory extends to non-Indigenous people, and how colonialism is a set of land relations that can travel to places that may or may not have Indigenous peoples, the last sentence in this quote is for you.

9 See footnote 77 in the introduction on why I use the term *dominant science* instead of *Western science*.

Not All Pollution Is Colonialism

The land relations behind the definition of pollution as the moment after assimilative capacity is surpassed have become so naturalized that other ways of discarding, based in other worldviews, have been obfuscated and even eliminated. When most people refer to waste and pollution today, they are referring to a set of relations that uses Land as a sink for a relatively new form of waste characterized by unprecedented tonnage, toxicity, and heterogeneity,[10] created within industrial political economies premised on growth and profit. But not all forms of pollution and waste are colonialism.

> *The settler woman is telling us (a group of Indigenous delegates) about how she admires that Indigenous people use the whole animal. I immediately think of the seal hunting*[11] *trip that* CLEAR*'s Inuk community coordinator just returned from to gather food and scientific samples. On her first day back to the lab I asked if they got sealskins. She said that beautiful as they are, the skins are too hard to remove and prepare these days, so they took the meat, gastrointestinal tracts, jaw bones, and biopsies and let the rest of the seal slide back into the water. They certainly didn't "use" the whole animal. This didn't bother either of us: the seal will be used by other animals under the ice. In fact, when we're done researching the seal guts, we'll return them to the Land to feed our relatives as well. I decide not to tell the woman any of this. After all, she's not exactly wrong, and I have no energy for nuance today.*

Other ways of discarding have been obfuscated by the dominance of modern, Eurocentric meanings.[12] From a scientific perspective, discarding seals and

10 This characterization of modern waste is from MacBride, *Recycling Reconsidered*.

11 Public service announcement from Newfoundland and Labrador and Inuit Nunangat (Inuit homelands) generally: seal hunting is not only legal and regulated in Canada, but a respected and respectful part of Inuit food webs, relations, and lifeways. Just as modern waste is characterized by massive tonnage, toxicity, and heterogeneity and is completely different than other forms of waste, so, too, does sustenance-based, traditional seal hunting differ from industrial seal hunting. If you're struggling with these ideas, I recommend Arnaquq-Baril, *Angry Inuk*. For me, seal hunting was the first blatant case where I fully understood that all feminisms are not also anticolonial. Awkward in a feminist *and* anticolonial lab.

12 One of the academic fields I work in is discard studies, the social science of waste and wasting (see discardstudies.com). I don't think I've come across a definition of waste in an academic space that doesn't either centre the human or conflate all nature and animals (and occasionally Indigenous people) as one kind of thing that wastes "naturally." If you know of any research that offers more nuance, please let me know.

discarding plastic packaging are materially different and have fundamentally different effects in ecological systems.[13] From an anticolonial perspective, the land relations that result in their discard are also different, based on fundamentally different L/land relations. Let's not conflate those differences.

Modern Environmental Pollution Is Colonialism

When I began this work, I wondered why modern environmental pollution was so easily economized. What allowed such complete capture of environmental regulation by industry to exist from the earliest moments of the twentieth century? It is not enough to say that industry and government's ability to pollute is a logical strategy to achieve the twinned pursuits of growth and capital. It is insufficient to say that Nature was understood by scientists to be a silver bullet to solve waste problems. What allowed these things to make sense in the first place? Why was not only the ability, but also the imperative, to pollute on the table at all? Under what conditions does managing, rather than eliminating, environmental pollution make sense?

That would be colonialism.

It's time to go deeper. Let's start with the basics: Land, Nature, and Resource.

Land

Defining Land by typing it out onto a page is like defining your favourite aunt as your mother's sister. True, yes, but your favourite aunt is more than that—she is the host of giant spaghetti meals and countless hours at the kitchen table teaching you how to draw horses. She is the one to tell you not to go with that man because he's no good.[14] She is the promise that someone will take care of you if something happens to your parents. So, too, with Land. If you'd like to learn more about Land, I recommend reading botanist Robin Wall Kimmer-

13 This is not just true of seals and plastics, but also of plastics and plastics. In 2015, I wrote, "The difference between PET plastics used in soda pop bottles and PVC plastic used for water pipes matters because the materials fragment, travel, and influence bodies differently. It matters whether that PET or PVC is in water, in a cod stomach, or on a store shelf because it will cause harm differently, and cause different types of harm, in each case." I have learned a lot since then, and the analysis could have used critiques of agency laid out by Vanessa Watts (Anishinaabe and Haudenosaunee). But the lesson about specificity and materiality in relations still holds and has only gotten stronger over time. M. Liboiron, "Redefining Pollution and Action," 5. See also Watts, "Indigenous Place-Thought."

14 For the academic equivalent, the "academic auntie," see E. Lee, "I'm Concerned for Your Academic Career If You Talk about This Publicly."

er's (Potawatomi) *Braiding Sweetgrass*, which beautifully narrates the ethos of Land though rich and interwoven narratives of knowledge, action, accountability, and beings.[15]

Defining Land makes it sound like a noun. But Land is a verb: "A bay is a noun only if water is *dead*."[16] Collaborators Eve Tuck (Unangax) and Marcia McKenzie (settler) write that Land "is both a notion and an action."[17] Land never settles. It is about relations between the material aspects some people might think of as landscapes—water, soil, air, plants, stars—and histories, spirits, events, kinships, accountabilities, and other people that aren't human.[18] These relations are happening all at once rather than being parceled into individual paired units, like plant to soil, mother to daughter. We have some plant mother soil plant mother going on.

Robin Wall Kimmerer writes that Land is "everything: identity, the connection to our ancestors, the home of our nonhuman kinfolk, our pharmacy, our li-

15 Thank you, Robin Wall Kimmerer. I first encountered your name as a signatory of the Indigenous Science Statement for the March for Science (http://www.esf.edu/indigenous-science-letter/). I was looking for other Indigenous scientists to learn with from afar. That's when I discovered the immense gift of your books, including *Braiding Sweetgrass*, which wove together law, Land, and science. It set the bar high, beautifully. Maarsi.

16 Kimmerer, *Braiding Sweetgrass*, 55; emphasis in original. Taking this further, la paperson writes, "The subjugation of land and nonhuman life to deathlike states *in order* to support 'human' life is a 'biopolitics' well beyond the Foucauldian conception of biopolitical as governmentality or the neoliberal disciplining of modern, bourgeois, 'human' subject [*sic*]." He adds, "The exercises of supremacist sovereign power over life and death are most chillingly undisguised when we consider the ways the life worlds of land, air, water, plants and animals, and Indigenous peoples are reconfigured into natural resources, chattel, and waste: statuses whose capitalist 'value' does not depend on whether they are living or dead but only on their fungibility and disposability. For example, in modern animal industrial processes, the carcass is valued just as much as, if not more than, the breathing animal." paperson, *A Third University Is Possible*, 5, 14–15. I never thought that reading a book about universities would be so rich with anticolonial environmental thought. Thank you, la paperson, for your words, your work, your collaborations, and your commitments to alliances against colonialism in its varied forms.

17 Tuck and McKenzie, *Place in Research*, 57.

18 Like many others, I struggle with the designation of *nonhuman* to mean everyone who isn't human since the term recentres the human at the moment you're trying not to. It's like calling all people who are not men, nonmen. The alternative *more-than-human* also leaves humans in the middle, though I appreciate its commitments. In everyday speech I tend to say "people," but then humans often think I'm talking about them again. I will use various terms in this text in an attempt to make as much sense as I can in any given moment. For more, see Chagani, "Can the Postcolonial Animal Speak?"

brary, the source of all that sustains us. Our lands were where our responsibility to the world [is] enacted."[19] In *Native Science*, science philosopher Gregory Cajete (Tewa, Santa Clara Pueblo) talks about relations with/in Land as "ensoulment," "a kind of a map of the soul" where the soul of the Land and of people are the same thing.[20] Enrique Salmón (Rarámur, Tarahumara) explains: "When [Indigenous] people speak of the land, the religious and romantic overtones so prevalent in Western environmental conversation are absent. To us, the land exists in the same manner as do our families, chickens, the river, and the sky. No hierarchy of privilege places one above or below another. Everything is woven into a managed, interconnected tapestry. Within this web, there are particular ways that living things relate to one another."[21]

This is CLEAR member Charles Mather's (settler) memory about learning a little about complex Land relations:

> *During the recreational food fishery, when people in Newfoundland can fish legally, we go to the wharfs where people are filleting their fish and ask for the fish guts. Sometimes commercial fishers are also at these docks, and we ask them as well. We get hundreds of guts this way every season. This approach to sample collection aligns well with our commitment to accountability and to good relations. Legally, cod must be gutted on the wharf and cannot be processed at sea. Fishers, both commercial and recreational, typically discard the guts into the sea around the wharf, keeping the tasty fillets, cod cheeks, and britches. So our samples come from something that has to be processed on the wharf, is not normally used by humans, and would have been thrown away. This is good.*
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> *But in our second year of sample collection on the wharfs around St. John's, someone else wanted cod guts. She wasn't interested in the guts for scientific purposes. She didn't want to know how much plastic the cod had ingested. Instead, she wanted to use the cod carcasses to make a soup or a broth. We thought the cod carcasses and guts were waste, but clearly that is not the case for everyone. We were surprised and taken aback. What had seemed such an ethically uncomplicated way of collecting samples had suddenly become deeply complicated. How could we take food away from someone in order to generate data in our lab? That didn't align well with our commitment to good relations.*

19 Kimmerer, *Braiding Sweetgrass*, 17.
20 Cajete, *Native Science*, 133.
21 Salmón, *Eating the Landscape*, 27.

> *This encounter has fundamentally changed the way we relate to people and fish on the wharf. We no longer work from the premise that the carcasses and guts are waste, to which we have exclusive and uncomplicated access. We approach sample collection more cautiously and with the sensibility that we cannot know with certainty all of the ways in which fish will be used. And we recall this experience with existing and new lab members to illustrate our commitment to humility in our scientific research practices.*[22]

See how tricky colonialism is?[23] Settler access to Land gets in at every turn: *We no longer work from the premise that the carcasses and guts are waste, to which we have exclusive and uncomplicated access*. Colonialism lurks in assumptions and premises, even when we think we're doing good.

The Land lesson I want to focus on here is about specificity. Unlike land, Land is fundamentally relational and is *specific* to these relations: "Every cultural group established this relationship to [their] place over time. Whether that place is in a desert, a mountain valley, or along a seashore, it is in the context of natural community, and through that understanding they established an educational process that was practical, ultimately ecological, and spiritual. In this way they sought and found their life."[24] This refers not only to the differences between St. John's and Toronto, but also to the relational differences between being a researcher and a fish harvester in St. John's, even if the researcher and fish harvester are the same person.[25] This is why Land is capitalized—it is the

22 This story was first written down in 2017 but occurred earlier, likely in 2015. Charlie, thank you for everything you have done for CLEAR and for me. Your presence as a full professor working within a young assistant professor's lab is not only an expression of CLEAR's commitment to different forms of knowledge and experience, but you have provided an invaluable sounding board, acted as a co-mentor, and been a source of enthusiasm for the lab during the difficult, complicated, and sometimes demoralizing (but also exciting, invigorating, and beautiful!) process of directing a feminist and anticolonial lab. Thank you! Readers, get this: Full professor Dr. Mather (and full professor Dr. Power) are not co-leads of CLEAR. They are members. They outrank me and work under my direction simultaneously, collaboratively, and this is good.

23 BTW, this doesn't make colonialism a trickster. If tricksters aren't yours, leave them alone. They will kick your ass.

24 Cajete, *Native Science*, 133.

25 This is a hard lesson to teach Indigenous people who become graduate students and thus researchers: as a researcher, you have fundamentally different obligations, relations, and legacies to account for than when you are just an Indigenous person fishing. You are part of the academy, a colonial project, and you are reproducing those relations even as you seek to change them. For example, research usually aims to generalize knowledge, even though

shorthand for all these relations as a proper name that is specific and unique, not universal and common.

Science Happens on Land

Science always happens within land relations, and those relations are always specific to that place, even if you don't believe in Land. The theory of assimilative capacity makes claims to universality, but the scientists who developed it, H. W. Streeter and Earle B. Phelps, were working in a specific place and they needed particular Land relations for their universal theory to work. They were looking at the Ohio River in the Ohio River Valley, which was not only saturated with municipal organic waste, but also a site for large-scale disposal of coal-tar waste. The interaction between the coal-tar wastes and the chlorine used to disinfect municipal water supplies made the water taste and smell repugnant. The result was that people were choosing to drink more palatable, untreated water over the disgusting-tasting treated water, even after the germ theory of disease was widely accepted. The resulting disease outbreaks came not from pollution so much as locals' choice to opt for drinking (palatable) polluted water despite the availability of (disgusting) potable water.[26] At any rate, the federal government saw the Ohio case as a unique crisis that chlorine treatment was no longer addressing and sent scientists to the river to see what could be done.

Phelps turned to the Ohio both because of his interests in public health and because the river's sluggish, wide, densely polluted waters offered laboratory-like conditions to prove his theory of assimilative capacity. An earlier attempt to

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in many cultures only Elders are supposed to make those sorts of bold statements. Your family and community members are now research subjects, collaborators, and beneficiaries of your work (both harm and benefit). Those are new relations. Some are incommensurate with existing relations. It is damn tricky to do research as an Indigenous person in your own communities. Thank you, Eve Tuck, for bringing these ideas up at the Labrador Research Forum in 2019 and in ongoing conversations, and to Ashlee Cunsolo for working on them with me for our students. See Tuck, "Research on Our Own Terms."

26 Historian Joel Tarr (unmarked) describes how, "in the mid-1920s[,] the U.S. Public Health Service . . . identified 25 cities in the Ohio River Valley where the interaction of chlorine with phenol wastes made the water almost undrinkable," and he links these aesthetics to "a typhoid outbreak of eighteen cases and three deaths in 1925 in Ironton, Ohio." Tarr, "Industrial Wastes and Public Health," 20. For more on the important role of aesthetics in pollution, despite scientific efforts to eradicate "subjective" aesthetics from understandings of pollution, see Christy Spackman's (unmarked) work: e.g., Spackman and Burlingame, "Sensory Politics."

prove assimilative capacity (what Phelps called self-purification at the time) in New York City's harbour had yielded promising results, but "there is evidently something wrong with our values at the region of Hell's Gate. . . . [A]n influence of the Harlem River shown here . . . was not properly taken into account in our computation."[27] Harlem will do that. While Phelps argued that his "general formula and hypotheses [of the ability of rivers to self-purify themselves of pollutants] are substantially accurate,"[28] he also knew that the noisy, not-very-laboratory space of New York Harbour was too tangled to emphatically prove his theory of self-purification. He needed the slow and straight Ohio River.

The concept of self-purification was first developed and studied in Britain, but it became a dominant scientific fact in the United States only after the work of Phelps, Streeter, and others. In 1860, British scientist Edward Frankland (unmarked), an expert responsible for keeping London's drinking water disease-free, noted, "There is no river in the United Kingdom long enough to effect the destruction of sewage by oxidation."[29] Outbreaks of typhoid at the time seemed to confirm this. I'd like to think it was the great lengths of American rivers compared to short and overpopulated British ones that allowed self-purification and the threshold theory of pollution to be further developed by Streeter and Phelps.

By articulating the Ohio River as a proper sink for pollution, Phelps and Streeter transformed it from a complex set of relations to one consisting of only a few relevant factors, what Jackie Price (Inuk) calls a "metaphysical flattening."[30] This is, as we shall see, a theme in colonial science's approach to Nature. The tension between universalism and emplacement—attempts to order and control Nature despite Land's relational specificity—offers me an opportunity to denaturalize the land relations of dominant science in favour of other ways of relating to the world, even (and especially) when dominant science seems to have a monopoly on describing land relations.

27 Phelps, "Chemical Measure of Stream Pollution," 533. Despite the disruption of data around Hell's Gate, Phelps held that the overall dataset still aligned with his theory of self-purification. But it wasn't quite enough to constitute a theatre of proof that made his claim so self-evident that the truth could speak for itself. The term *theatre of proof* comes from Latour, *Pasteurization of France*.

28 Phelps, "Chemical Measure of Stream Pollution," 533–34.

29 Rivers Pollution Commission, "Sixth Report," 138. For excellent research on the scientific struggles of water purification in the context of governance in Britain, see Hamlin, *Science of Impurity*.

30 Jackie Price, "But You're Inuk, Right?"

Nature

Small-*l* land is usually synonymous with Nature, in that both focus on only some aspects of relations, such as soil, air, water, animals, and plants, but not on human people, events, memories, spirits, or obligations.[31] Nature describes colonial relations with capital-*L* Land.[32] Whether Nature is understood as wild and heartless, the helpless victim of industrial assault, or the raw stuff of scientific enquiry, one of Nature's defining characteristics is that it is separate from humans, even if there is a closeness or affinity between them.

Separation

The naturalization of separation allows the scientific logic of variables to make sense—variables are ways to treat elements of an environment as discrete, autonomous actors.[33] For Streeter and Phelps, the variables that mattered to their theory included the flow rate, volume, temperature, time, and oxygen levels of the water, all of which were related but could nevertheless be separated from one another and independently measured.

For Streeter and Phelps, the key Natural phenomenon under study was self-purification, a phenomenon they believed could be graphed and used to predict

31 A "construction of nature" analytic flourished in the late 1990s and early 2000s, characterized by studies that examined how human-environment relationships became constructed via epistemology, cultural discourses, economic structures, and more. The when, how, and why of Nature's separation from (some) humans has been written about extensively, as, for example, in the following works: Merchant, *Reinventing Eden*; Schiebinger, *Nature's Body*; Jennifer Price, *Flight Maps*.

32 The terms *land*, *nature*, and *resource*, with or without capitals, are used in a variety of settings, including Indigenous ones. I am not the word police: people can use any of these terms to mean what they're trying to say. Many of us use the language of colonizers to mean things that exceed colonial worldviews (that's part of what colonization does!). If you're using these terms in your tribal council, traditional teachings (including Natural Law), writing, or everyday speech with other Indigenous people, keep on if it's working. I'm setting up these terms within this book so I can be clear about what I mean when I use them. Thank you, Kim TallBear, for conversations about words and their multiple meanings, and specifically about Elders who speak their traditional language and use the term *Creator* in their prayers—they might mean the Christian God, but they might also mean that-mystery-that-things-come-out-of-that-is-probably-related-to-stars-but-how-could-we-possibly-know-since-that-would-be-rude. Or similar.

33 This isn't to say that variables are "wrong" or fundamentally colonial things (they don't automatically grant access to Land for colonial goals), but to point to how worldviews allow some things to make sense and act as truth at the expense of other things.

when a river can no longer reintroduce enough oxygen to metabolize organic waste. What didn't matter to this universal phenomenon were things like smell, fish health,[34] water colour, or whether the river was nice to swim in, all of which had been used to define pollution in the past. The Streeter and Phelps equation implicitly argued that smells, fish, and swimmability, among other relations, were not essential characteristics of river pollution. Instead, oxygen levels and their variables became the focus of purification and thus of its opposite, pollution.

After empirically testing their variables, Streeter and Phelps arranged them in fixed and predictable relations—that is, they built a model. For each variable, they used measurements from the Ohio River to determine when the oxygen demand of metabolizing waste exceeded the reintroduction of oxygen into the stream (called re-aeration). Then they graphed the results.

There it is! You can see it in black and white![35] The failure of the river to purify itself is represented, over and over again, in the droop of the curve. The point at which each curve droops and flatlines for a moment is the point at

34 One source of pushback against Streeter and Phelps's equation concerned fish health. In 1933, fisheries scientist Carl L. Hubbs (unmarked) argued that fish health could not be totally captured by oxygen rates, and that the time of day, an essential characteristic that impacted fish health, was absent from Phelps's variables. But this critique, as well as others, did not reject the premise that a complete set of essential characteristics for pollution could be mathematically articulated. Instead, these critiques argued for increasing the number of variables and complexity of the pollution models while still maintaining that Nature and its pollutants could be understood and intervened in. Hubbs, "Sewage Treatment and Fish Life."

35 Here is the theatre of proof! Latour (unmarked) talks about the role of theatrical charisma in changing scientific paradigms when he tells the story of Louis Pasteur and his highly unlikely microbes: "Pasteur's genius was in what might be called the theater of the proof. Having captured the attention of others on the only place where he knew that he was the strongest, Pasteur invented such dramatized experiments that the spectators could see the phenomena he was describing in black and white. Nobody really knew what an epidemic was; to acquire such knowledge required a difficult statistical knowledge and long experience. But the differential death that struck a crowd of chickens in the laboratory was something that could be seen 'as in broad daylight.' Nobody knew what spontaneous generation was; it had given rise to a highly confusing debate. But an elegant, open, swan-necked bottle, whose contents had remained unalterable until the instant the neck was broken, was something spectacular and 'indisputable.'" Latour, *Pasteurization of France*, 85. Thomas Kuhn also talks about the central role of persuasion and beauty in shifting scientific paradigms: "Because [paradigms] differ about the institutional matrix within which political change is to be achieved and evaluated, because they acknowledge no supra-institutional framework for the adjudication of revolutionary difference, the parties to a revolutionary conflict must finally resort to the techniques of mass persuasion." Kuhn, *Structure of Scientific Revolutions*, 93. So, too, with pollution.

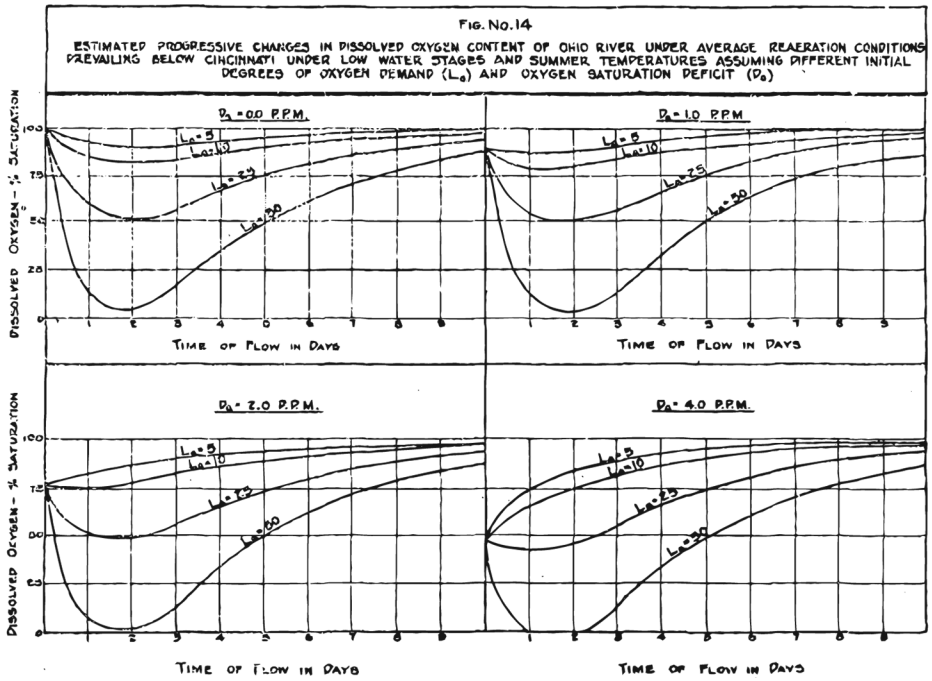

FIGURE 1.1. The bottom curve of each line shows when the oxygen rate could not replenish under different pollution loads (L_a marks different degrees of oxygen demand in relation to higher quantities of organic contamination), and the climb of the line back to the top axis shows the slow regain of oxygen. This is one of several graphs in the report, all with similar curves showing different variables. Image from Streeter and Phelps, *Study of the Pollution and Natural Purification of the Ohio River*, 81.

which increasing time or water velocity does not contribute to an increase in oxygen rates. It is the moment where imbalance occurs and the river chokes. Today, this curve is called an oxygen sag, and the point at the bottom is called the critical point. It is the line that marks the moment of modern environmental pollution. In different places, with different variables, and different amounts of organic pollutant, the numbers and tilt of the curve might change, but the essential sigmoid shape of the curve is the same each time.

Universalism

Based on the consistency and regularity of these results, Streeter and Phelps declared, "It has been shown in the foregoing text that the oxygen self-purification of the Ohio River is a *measurable* phenomenon, governed by *definite laws* and

proceeding according to certain fundamental physical and biochemical reactions. Because of the fundamental character of these reactions and laws, it is fairly evident that the principles underlying the phenomenon as a whole are applicable to virtually *all* polluted streams."[36] All streams? What luck! Streeter and Phelps had answered the regulatory wet dream of governing across different places. Now it did not matter if the pollution was of one kind or another, if the water was in a stream or in a tank, in the slow and cooperative Ohio River or the complex and naughty New York Harbour.[37] Legibility across jurisdictions, scales, materials, and contexts is likely a core reason Streeter and Phelps's equation for assimilative capacity was so immediately successful, taken up by regulatory bodies in both theory and practice and hailed as a classic within two decades.[38] Also crucial to its success was the fact that assimilative capacity allowed some dumping of waste to occur. Instead of changing systems that allowed industrial effluents to begin with, governance could turn to technical efforts to locate and manage allowable limits. This is the foundation of the permission-to-pollute system.

The power of "discovering" (read: labouriously crafting) scientific phenomena that hold across bodies of water lies in the Western concept of universalism. Universalism is the claim that "certain principles, concepts, truths, and values are undeniably valid in all times and places and, by extension, the characteristics of phenomena are invariant. Universal knowledge is therefore the opposite of local, particular, and situated. . . . It is transcendental, placeless, and untouched by context."[39] Universalism requires fungibility or "exchangeability. Fungibility

36 Streeter and Phelps, *Study of the Pollution and Natural Purification of the Ohio River*, 59; emphasis added.

37 Many authors have argued that exact, quantifiable definitions and processes are favoured in a policy context, as they lead to fewer discussions and conflicts become solvable. Maarten Hajer (unmarked) argues that quantification is a form of definition that "institutions can handle and for which solutions can be found." Hajer, *Politics of Environmental Discourse*, 15. Also see Verran, "Numbers Performing Nature"; Igo, *Averaged American*; and Bäckstrand, "What Can Nature Withstand?"

38 E.g., Bloodgood, "Water Dilution Factors for Industrial Wastes." A mark of Phelps's success was his placement on the board for the *Report of Committee on Standard Methods of Water Analysis to the Laboratory Section of the American Public Health Association*, the authoritative text for American municipal water workers, which is still in use today. His tenure introduced the first empirically tested thresholds for pollution into the handbook, and they remain there today nearly one hundred years later, tweaked but essentially unchanged. For the most up-to-date version of the century-old handbook, see American Public Health Association, American Water Works Association, and Water Environment Federation, *Standard Methods for the Examination of Water and Wastewater*.

39 That is, the opposite of Land. Castree, Kitchin, and Rogers, "Universalism."

also means getting anatomized into exchangeable parts to be stored, shipped, sold, combined with other parts,"[40] the kind of work that variables do. Streeter and Phelps were scientific universalists, looking for (read: painstakingly creating) universal, fungible traits of self-purification.

Angela Willey (unmarked) writes that most Western sciences, as well as other academic traditions, offer "ultimately totalizing scientific explanations of the world and our place in it [marked . . .] by an implicitly Judeo-Christian brand of secularism that allows us to imagine nature as law-governed." She continues, describing this approach as characterized "by a Eurocentric protomodernity that separates the rational from the irrational,"[41] separates (some) humans from Nature,[42] and separates variables from the background noise of Nature.

The universal is never universal, but rather an argument to imperialistically expand a particular worldview as *the* worldview. Comparative philosopher Mary Graham (Kombumerri, Gold Coast) summarizes these epistemological and ontological beliefs when she writes:

> For most Westerners reality is what it is irrespective of what humans think or know about it; secondly, that reality is ordered, that it has a structure that is universal and invariant across time and place. They claim that the structure and forces of the natural world remain the same in different times and in different contexts. They also believe that this structure is knowable and that Western science has provided the ability to explain, predict and control many natural phenomena and to invent technologies to solve human problems.[43]

This knowledge system provides a top-down, all-encompassing view that feminist Donna Haraway (unmarked) has called the god trick, "seeing everything

40 paperson, *A Third University Is Possible*, 13.

41 Willey, *Undoing Monogamy*, 993. As you can see from the citation, the politics of universality, particularly their spread and enforcement via colonialism, has wide-reaching effects from pollution to sexuality. Though it is not written from an anticolonial perspective, for a history of universalism and science, including its relationship to civilized civilizations, nationality, Christendom, institutional and competitive internationalism, and modes of governance, see Somsen, "History of Universalism." White supremacy and racism are not covered in the article, though it does cover World War II and German nationalism, including Nazis and genocide. Weird, right? As an antidote, the following text is very good on linking the role of universalism to race, racism, and Nature: Moore, Kosek, and Pandian, *Race, Nature, and the Politics of Difference*.

42 Moore, Kosek, and Pandian, *Race, Nature, and the Politics of Difference*.

43 Graham, "Understanding Human Agency in Terms of Place," 71.

from nowhere."[44] It is unattached, unaccountable. No wonder Nature was born from this worldview.

Since the Enlightenment, a goal of universal science has been what science historian Lorraine Daston (unmarked) calls "European self-portraiture," particularly as the borders of Europe became extended and even ambiguous during (ongoing) imperial and colonial conquests—the goal was to make mini-Europes and Europeans through science.[45] Imperialism and colonialism both involve the scientific appropriation of local and Indigenous knowledges, eaten up and digested to create dominant scientific knowledge.[46] Historically, this included botany and the cultivation of economically valuable plants,[47] an interest in climate[48] and the expansion of agriculture,[49] and the control of diseases such as malaria,[50] all of which enabled successful settlement.

Simultaneously, the dominant scientific knowledge system was and is of-

44 Haraway, "Situated Knowledges," 581.

45 Daston, "History of Science." Though for more on how the making of European subjects via science never quite worked for colonized subjects, see Seth, "Putting Knowledge in Its Place." Thank you, Suman (unmarked), for your work, but also for your candor, generosity (especially knowing and taking the time to introduce me to local water), and collegiality.

46 The legacy of dominant and imperial science eating up and getting fat off of local and Indigenous knowledge is fashionable again today in the grant-supported drive for Traditional Ecological Knowledge (TEK), Traditional Knowledge (TK), and Indigenous Knowledge (IK). While dominant science's aims are often articulated as a drive toward inclusion (into Empire, I assume), its attempts to "incorporate" (use, assimilate, ingest, nom nom nom) Indigenous knowledges are often another form of colonialism that extends the reach of colonial and settler goals by acquiring more types of data. Most scientists and staff at federal granting agencies I work with do not appear to understand that TEK et al. are about ways of knowing, not what is known. Ain't no data in TEK. This is the main reason CLEAR *does not* claim to engage in TEK knowledge collection (ew), integration (ow!), or use (ugh). This doesn't mean that some of our Indigenous members and colleagues don't use their own diverse knowledges to get scientific work done—it means we don't make that legible or available for munchies. More of this in chapter 3. For articles on the perils of inclusion of TEK, etc., see McGregor, "Traditional Ecological Knowledge"; Reo, "Importance of Belief Systems in Traditional Ecological Knowledge Initiatives"; Nadasdy, "Politics of TEK"; Nadasdy, "Anti-Politics of TEK"; and Dene Nation and Assembly of First Nations, "We Have Always Been Here."

47 Schiebinger and Swan, *Colonial Botany*; Brockway, "Science and Colonial Expansion."

48. Zilberstein, *Temperate Empire*.

49 Knobloch, *Culture of Wilderness*.

50 Fanon, "Medicine and Colonialism"; Nash, *Inescapable Ecologies*; Bashford, "'Is White Australia Possible?'"; Lyons, *Colonial Disease*.

ten articulated as a reason for colonialism: "The idea that science and technology were among the gifts that Western imperial powers brought to their colonies was an integral part of the discourse of the 'civilizing mission,' one vaunted by both proponents and critics of the methods of colonialism."[51] Christianity, residential schools, and dominant science were different techniques through which colonizers claimed to bring light to the darkness of primitivism while simultaneously maintaining a difference between the colonized and colonizers.

Feminist scholar Helen Verran (white [oyinbo]) describes the "abhorrent moral economy" of teaching dominant science and mathematics to colonized peoples, or even just well-intentioned comparative analyses of different knowledge systems. She writes how Yoruba counting and knowledge "could only be taken as an echo, a shadowy form of English logic. The schema reenacts the categories of a universal modernity, originating in European traditions, and a Yoruba echo of a necessarily European modernity. Either way, a distinct 'us' and 'them' are locked forever together, and apart, through the spectre of originality/mimicry. . . . The only way to tell such difference is to pull 'their' world into 'ours.'"[52] This kind of access—being able to pull entire worlds into dominant worlds—is a hallmark of colonialism.

In short, dominant science can be used to fuel a militant universalism where a single knowledge becomes the touchstone for all other knowledge systems, which either can dismiss and erase other forms of knowledge or can place those knowledges in the waiting room of modernity[53] as late, quaint, cute, curious, undeveloped, and consumable for settler desires, well intentioned or not. This is not just a historical problem.

51 Seth, "Putting Knowledge in Its Place," 373. This discourse is alive and well today. STEM camps for Indigenous youth are a mainstay of grants and (settler) institutional celebrations at my university, where the assumption is that STEM will lift up, enable, empower, and otherwise better Indigenous youth. It remains a civilizing force, a force to bring "them" in line with "us," a way to diversify empire. It is a constant battle to remind people that Indigenous people already have robust ways of knowing, in place, and using scientific degrees or university enrollments of Indigenous people is only a metric of success within a colonial logic. See Megan Bang's work for a different take; e.g., Bang and Medin, "Cultural Processes in Science Education."

52 Verran, *Science and an African Logic*, 31. This text is excellent in terms of showing a sustained engagement in the tensions between universalism and specificity in counting, which is often assumed to be the most universal act of STEM knowledge.

53 Chakrabarty, *Provincializing Europe*.

There's a story we tell in the lab about the academic peer review of our first cod paper.[54] *Since we collected guts from fishers, the reviewer wants to know: "how did the authors know they were cod?" I remember reading the question out loud during the lab meeting and people laughing. Of course, it was cod—the fishers said so! Cod is a major part of the culture, heritage, diets, livelihoods, songs, and life for the settlers on the island of Newfoundland that we got the cod from. Babies know what cod is! Since we could not write "because Newfoundland" in response to the reviewer and still be published, we assured them that a lab member was present during gutting. More laughing. Sometimes, that person was our newest lab member, Alex, who has the most scientific training of the group but is also from landlocked and cod-less Saskatchewan. Someone in the lab jokes, "He couldn't tell a goldfish from a mackerel." Alex is a good sport—he mimes confusion. The reviewer accepts our explanation: There was a scientist present. The paper is published.*

One Pollution, One Nature

So Many Pollutions

Before he went to the Ohio River, Phelps wrote, "Of immediate and pressing interest is the fixing of standards of permissible pollution, which will comply with the common law conception of reasonable use and develop the maximum advantageous use of the streams."[55] It's not that Phelps was a jerk—on the contrary, he might be considered a proto-conservationist who sought to find the maximum use of a waterway *without* abandoning it entirely to pollution, the common practice at the time.[56] Phelps was working in an environment where the pressing scientific, public health, and governance question was to find the demonstrative difference between polluted and safe drinking water. It was a big problem. In 1868, commissioners in Britain who had been appointed to craft what would become the Rivers Pollution Prevention Act wrote, "There is no such thing as absolutely pure water in nature, and the waters met with in our springs, lakes, rivers, and sewers, form a series gradually increasing in dirtiness;

54 The published paper in question is M. Liboiron et al., "Low Plastic Ingestion Rate in Atlantic Cod (*Gadus morhua*)." This is also the paper that used the guts that Charlie tells the story about earlier in this chapter.

55 Phelps, "Stream Pollution," 928.

56 Tarr, "Industrial Wastes and Public Health." Also see Phelps, "Discussion."

there is actually no definite line of demarcation separating the purest spring water from the filthiest sewage. . . . It is, therefore, obvious that, for the purposes of efficient legislation, an arbitrary line must be drawn between waters which are to be deemed polluting and [those deemed nonpolluting]."[57]

Before Streeter and Phelps made that line less arbitrary, definitions of environmental pollution proliferated. Some were chemical, focusing on traceable aspects of sewage: "[Polluted water is] any liquid containing, in solution, more than two parts by weight of organic carbon, or 3 parts by weight of organic nitrogen in 100,000 parts by weight."[58] Even with the advent of the germ theory, there was no bright white line to demark exactly how many germs would constitute unsafe water: "[*B. coli*'s] presence in water is to some extent indicative of pollution, although its abundance rather than its mere presence must be considered as the criterion."[59] But what abundance? Other definitions of pollution were aesthetic or available to lay evaluation: "A 'relatively purified' river: Should no longer make the stream slimy or muddy, should contain neither the remains of beetroot or cosettes"[60] and should be "tasteless and inodorous . . . and is incapable of putrefaction, even when kept for some time in closed vessels at a summer temperature."[61] The range of analysis was dizzying—not what a centralized government wanted.[62] The adoption of the threshold theory of pollution that the Streeter-Phelps equation promised allowed regulatory bodies to replace these varied definitions with a single one based on assimilative capacity.

57 Glen, "Appendix B," 75.

58 Bailey-Denton, "Sewage Disposal," 9.

59 American Public Health Association et al., *Standard Methods for the Examination of Water and Sewage*, 84. While a 1914 water-quality standard for interstate trains—the first in the United States—provides a maximum number of bacteria in a sample (100 per cubic centimetre), it also states that in "the attempt to establish limits of this kind it [is] inevitable that manifold difficulties should have been encountered[, including] the difficulty inherent in any attempt to establish an exact line of demarcation between two such extremes as undoubtedly safe water supplies and those which should assuredly be condemned." Monfort, "Special Water Standard," 66, 69. This sentence disappeared from the text after Phelps joined the committee that wrote the *Standard Methods.*

60 Naylor, *Trades Waste*, 5–6. I have been unable to identify what a cosette is, though I look in my water regularly, ever hopeful.

61 Massachusetts State Board of Health, *Seventh Annual Report*, 26.

62 In addition to writing about the history of water chemistry and analysis, Christopher Hamlin (unmarked) has also written about another area of universalization—that of water. Water also used to be a lot of different things. Hamlin, "'Waters' or 'Water'?"

Managerial Ontologies

The threshold—that arbitrary line between pollution and nonpollution, made less arbitrary through oxygen sag—is where policy, accountability, and responsibility come together.[63] When Phelps laid out his theory of assimilative capacity in 1912, he argued that, once the self-purification rate of a river was determined,

> the ultimate oxygen requirement of the sewage of a community expressed in pounds per day may then be balanced against the available oxygen resources of the stream into which this sewage is to be discharged, and the resulting figure will show the effect of such discharge upon the dissolved oxygen of the stream. If the effect is to reduce the dissolved oxygen of the stream below the permissible point, further purification [by municipal systems] is indicated. If two or more communities are contributing to the same body of water the total oxygen of the water may be apportioned in an equitable manner between them.[64]

The logical extension of quantifying the threshold of pollution was to parcel out assimilative capacity—essentially, the ability to waste, even the right to waste—to polluters. The area under the curve became a sacrifice zone,[65] designed for pollution.

Managing the line between contamination and pollution, now differentiated as fundamentally different states, became a defining feature of environmental governance, and remains so today.[66] The first public standards for drinking water in the United States included threshold "concentration limits for lead, fluoride, arsenic, and selenium."[67] Writing about the history of toxics regulation,

63 For brilliant work on this concept from a present-day, European pollution governance perspective, see Olsson, "Setting Limits in Nature and the Metabolism of Knowledge."

64 Phelps, "Chemical Measure of Stream Pollution," 534.

65 Lerner, *Sacrifice Zones*.

66 The way that assimilative capacity, natural thresholds, and the ability to pollute to a specific level have combined to become a defining feature of current-day environmental regulation is covered by excellent research in the natural sciences, environmental management, social sciences, and history, including Busch, "Use and Abuse of Natural Water Systems"; Walker, *Permissible Dose*; Olsson, "Setting Limits in Nature and the Metabolism of Knowledge"; Lueck et al., "Determination of Stream Purification Capacity"; Sayre, "Genesis, History, and Limits of Carrying Capacity"; Firth, "Status of Water Quality Modeling in the Pulp and Paper Industry"; Schneider, *Hybrid Nature*; and Hajer, *Politics of Environmental Discourse*.

67 United States Public Health Service, "Public Health Service Drinking Water Standards," 373.

environmental historian Frederick Davis (unmarked) writes that the role of the United States' federal Environmental Protection Agency "is to implement the pollution control laws enacted by Congress. Its most important function in this respect is to establish National standards that govern *how much pollution is allowable*."[68] Earlier periods' flexibility and diversity of what counted as pollution diminished to the point of irrelevance[69] from a policy and scientific standpoint. Pollution became—is—assimilative capacity.

Thresholds Abound

Streeter and Phelps did not develop their ideas in a vacuum. Other sigmoid (*S*-shaped) curves that showed threshold moments were being produced in the early decades of the twentieth century across scales, nations, and disciplines. For example, Aldo Leopold (unmarked), the famed American environmentalist, used the concept of carrying capacity to manage wildlife areas in the early 1930s, using a sigmoid curve to show how populations would level off.[70] He then designed landscapes to carry a maximum load of animals.

Leopold's large-scale field experiments had already been anticipated by "laboratory studies of fruit flies, flour beetles, or other convenient organisms"[71] raised, studied, and extinguished in glass vials. Their lives and deaths produced *S*-shaped population curves, as did the population data of colonized Algeria, a

68 F. Davis, *Banned*, 2; emphasis added.

69 Since Streeter and Phelps, there have been ongoing critiques and pushback on the concept of assimilative capacity from *within* the sciences. The list of these critiques (below) used to contain two pieces that have been removed, which were two of the works most aligned with my own historicization of how certain toxicological truisms were built in specific ways. But it turns out the author is a litigious thinker dedicated to undoing all forms of environmental monitoring, threshold and otherwise, in the service of polluting industries. I point this out for two reasons. First, I am making absent citations conspicuous as part of a politics of citation. Since citation is a reproductive technology, a way to build and rebuild fields of knowledge, and a form of action, I want to both omit and mark that omission. Second, I want to highlight how data and analysis never speak for themselves. The same data or critique can be used to further opposing concepts of what is good, right, and true. Industry has activists, too. Susan Sontag (unmarked) makes this point for evidentiary photography in *Against Interpretation*. For citable work that critiques assimilative capacity from a scientific perspective, see Busch, "Use and Abuse of Natural Water Systems"; Campbell, "Critique of Assimilative Capacity"; Cairns, "Assimilative Capacity Revisited"; Cairns, "Threshold Problem in Ecotoxicology"; Westman, "Some Basic Issues in Water Pollution Control Legislation"; and O'Brien, "Being a Scientist Means Taking Sides."

70 Leopold, *Game Management*.

71 Odum, *Fundamentals of Ecology*, 123.

"natural experiment" on colonized not-quite-humans.[72] Before the term *assimilative capacity* was used to describe organic waste in water, a version of the term was used in nutrition science to describe thresholds in the absorptive powers of the body, "used to designate broadly the ability of the organism to convert the digested nutrients of the feed into body tissue."[73] The scale of the body had long been associated with thresholds for harm—this is the very premise of toxicology since Paracelsus (unmarked) famously stated, "What is there that is not poison? All things are poison and nothing is without poison. Solely the dose determines that a thing is not a poison."[74] By the 1920s and 1930s, when Streeter and Phelps were conducting their work, pharmacology treated sigmoid curves as normal and natural, and toxicological debates pivoted on how those curves should be interpreted and how drugs should be managed, not on the theory of the threshold itself.[75]

By the early twentieth century, the terms that described thresholds, including *assimilative capacity*, *critical load*, *tolerance dose*, *permissible dose*, and *carrying capacity*,[76] were appearing with increased frequency across new and established sciences, applied to scales from cells to landscapes. These *S*-shaped curves offered a density of evidence that harm could be defined as strain that surpassed tolerable limits, rather than a symptom, a discontinuity in aesthetics, a moral dilemma, or another less quantifiable phenomenon. The ubiquity of *S*-shaped curves across different geographies, different bodies, different toxicants, and different scales was interpreted to mean that threshold relations were characteristic of Nature itself, that is, universal.

72 Pearl, *Biology of Population Growth*. One of the most famous of these human population curves is Meadows, Randers, and Behrens, "Limits to Growth." For more on how these curves shaped the discipline of ecology, see Kingsland, *Evolution of American Ecology, 1890–2000*. For more on the politics of population statistics, see Murphy, *Economization of Life*.

73 Armsby, *Nutrition of Farm Animals*, 441.

74 Quoted in Grandjean, "Paracelsus Revisited," 126. For more on the body as a sink for pollution, see Agard-Jones, "Bodies in the System"; Brown, "Last Sink"; and Cram, "Becoming Jane."

75 E.g., Clark, *Mode of Action of Drugs on Cells*.

76 The term *carrying capacity* has a history starting in the 1840s in reference to calculating loads that international ships could carry, before it branched into biology, ecology, and statistics. An excellent history of the term is Sayre, "Genesis, History, and Limits of Carrying Capacity."

Making a Nature Robust within Limits

Just as there were competing definitions of pollution before assimilative capacity, there were also competing definitions of Nature. In *Risk and Blame*, anthropologist Mary Douglas (unmarked) recounts four different cultural views of nature: nature as robust (nature can handle any human intervention), nature as robust within limits (nature can handle human intervention up to a certain point), nature as fragile (nature cannot handle human intervention), and nature as capricious (nature will be unpredictable in the face of human intervention).[77] Streeter and Phelps, with many others, appeared to have provided empirical evidence that nature is indeed robust within limits.[78] They argued that these limits could be precisely located and managed. Pollution became a threshold at the same time that Nature became robust within limits.

Historian Wiebe Bijker (unmarked) might have been writing about pollution and Nature when he wrote that scientific "consensus means that the interpretative flexibility of, for example, an observation statement disappears, and from then on only one interpretation is accepted by all. Such a closure is not gratuitous but has far-reaching consequences: it restructures the participants' world."[79] In this case, one out of many versions of Nature and pollution was naturalized. On the bright side, Bijker writes, "It is in principle always possible—although in practice very difficult—to reopen up a controversy once closure is reached."[80] That's what CLEAR is here for.

Canada is gearing up to make Big Plastic Plans at the federal level. I'm on one of many calls organized by the federal government with plastic pollution

77 Douglas, *Risk and Blame*, 263–64.

78 I cannot overstate the success of this version of Nature. An extreme but quintessential manifestation of the idea that Nature can handle a certain amount of pollution and that this is the proper role for Nature is the story of James Lovelock (yes, the Gaia hypothesis guy), who argued that Gaia (a.k.a. the planet) wanted or at least welcomed a certain amount of pollution to help with maintaining planetary bias. Lovelock published these ideas while under the employ of ExxonMobil (yes, the oil guys). In her exploration of this fascinating story, historian Leah Aronowsky (unmarked) argues that this concept of natural assimilation is the conceptual premise of climate change denial. Aronowsky, "Gas Guzzling Gaia." See also an amazing ad that Aronowsky uses to frame the story, where Mobil argues, "Our point is that nature, over the millennia, has learned to cope. Mother Nature is pretty successful in taking on human nature": ExxonMobil, "The Sky Is Not Falling."

79 Bijker, *Of Bicycles, Bakelites, and Bulbs*, 85.

80 Bijker, *Of Bicycles, Bakelites, and Bulbs*, 85.

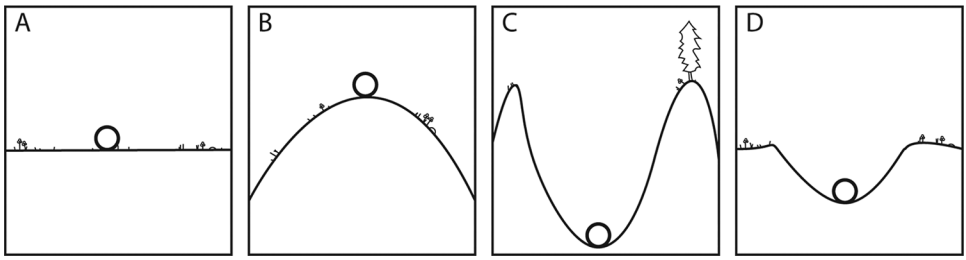

FIGURE 1.2. The four myths of Nature. (A) Nature is capricious: the ball can roll anywhere, anytime. (B) Nature is fragile: the ball can roll off at any moment! (C) Nature is robust: that ball is not going anywhere. (D) Nature is robust within limits: the ball will roll out if we push too hard. Illustration by Max Liboiron. CC-BY 3.0.

scientists from across the country. We're talking about how there are no established standards for analysing and reporting marine plastic research and how this makes studies difficult to compare and validate, a reoccurring discussion in the field. Someone brings up how we should establish a threshold for plastics. I startle and mash on the buttons to unmute my mic, accidentally hanging up on the call. I call back faster than I've ever called into a conference call before and exclaim, "Plastics are not a threshold pollutant!"[81] *The other scientists and feds hear me out, and in the end agree that maybe we don't want to articulate a threshold,*[82] *since "industry" (which includes the*

81 This is not the same as exclaiming, "Fuck thresholds and the horse they rode in on!" Saying that plastics are not a threshold pollutant is a scientific statement that aligns plastics with other pollutants like radiation or carcinogens where there is no "safe dose." I do not always say what I mean when doing political work as a scientist—I often say things adjacent to what I mean so that I can remain legible to my audience. The threshold theory of pollution is not really up for debate, and discussions of universalism, thresholds, and colonialism simply won't make sense on a federal conference call. This is one way to talk about compromise, which will be covered more in chapter 3: activism happens on a terrain that is already laid out, has already been identified as unjust and in need of change, and you have to make some sort of sense in that terrain to change it.

As a side note, even a statement about plastics not having thresholds is not guaranteed to circumvent a threshold theory of harm. Nonthreshold pollutants have been given thresholds via risk theory, where a specific amount of death or morbidity is an acceptable loss. The threshold theory of harm is strong and beloved. See the excellent work of Vogel, *Is It Safe?*; Cram, "Becoming Jane"; Walker, *Permissible Dose*; and Langston, *Toxic Bodies*.

82 Actually, there is an articulated threshold for plastics, of sorts. It's for Northern Fulmar, but it occasionally leaks into other contexts. It's called the Ecological Quality Objective (EcoQO) measure, and its threshold is 0.1 g /10 percent of individual birds within a

feds on the call, in my view) can use it as a permissible level to pollute up to. Other callers agree or stay silent. We move on to a different universalizing topic about the one best way to report microplastic findings. Small victories.

Update one year later: a Canadian federal funding call for research on plastics prioritizes research on "the biological, chemical or physical stressors introduced to ecosystem components by these contaminants to identify thresholds needed to disrupt biochemical, physiological or behavioral interactions between plastic, the environment, and organisms."[83] *The threshold theory of harm is formidable in its resilience.*

Resource

When Nature becomes robust within limits and threshold theories of harm are dominant, land relations become managerial rather than reciprocal. In colonial understandings of Nature, (certain) humans can protect, extend, augment, better, use, preserve, destroy, interrupt, and/or capitalize on robust-within-limits Nature. That is, Land becomes a Resource. Resources refer to unidirectional relations where aspects of land are useful to particular (here, settler and colonial) ends. In this unidirectional relation, value flows in one direction, from the Resource to the user, rather than being reciprocal as legal scholar Andrew Brighten (unmarked) notes in his interpretation of court proceedings on xʷməθkʷəy̓əm relations to salmon:

> The court quickly moves past a scant two sentences referencing the Musqueam social ontology of salmon and humans bonded in a reciprocal relationship, then distills this relationship to the activity of "taking"—

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population. Basically, 0.1 grams of plastic ingested by more than 10 percent of birds studied is too much. Scientists note, "This [EcoQO] target had no substantiated background of ecological or individual or population health. It represent[s] an arbitrary target considered to reflect 'acceptable ecological quality' as used in policy documents." This threshold does not come from Nature, or even from science, but from policy documents for the purpose of policy. Regardless of whether we want to argue that this is a good or bad measure, it shows just how strong the threshold logic is within dominant science and how it is *the* guiding logic in environmental governance within the colonial state. Provencher et al., "Quantifying Ingested Debris in Marine Megafauna," 1467. For more on the articulation of EcoQO as a threshold for policy rather than for harm, see the measure in action in Van Franeker et al., "'Save the North Sea.'"

83 Government of Canada, "Increasing Knowledge on Plastic Pollution Initiative."

> directly opposed to the Musqueam understanding of being given—salmon for food, social and unspecified "ceremonial purposes." The court then repeatedly characterizes Musqueam interaction with salmon as participation in an "economically valuable" "natural resource," [and] "recognizes" the desires of "numerous interveners representing commercial fishing interests." . . . This "resource management" mindset is not unique [to this court case].[84]

This passage documents the flattening of Land relations into Resource relations. In a colonial worldview, a Resource relation is good and right. A body of excellent scholarship critiques this notion of Resource as a colonial, settler, and imperial concept.[85] Building from this work, I will specifically focus on how the colonial logics of Resource are reproduced in practices and concepts of modern environmental pollution.

Standing Reserve

In "The Question concerning Technology," philosopher Martin Heidegger (unmarked)[86] describes a Resource-based arrangement of relations as a "standing re-

84 Brighten, "Aboriginal Peoples and the Welfare of Animal Persons," 39. Anglicisation of xʷməθkʷəy̓əm in the original.

85 For more on conflicting settler-state and Indigenous worldviews over the concept of resource, see Carroll, *Roots of Our Renewal*; Nadasdy, *Hunters and Bureaucrats*; and Reo and Whyte, "Hunting and Morality as Elements of Traditional Ecological Knowledge."

86 As you read what follows, you may notice that Heidegger is the first white man whose theories I've engaged with at length. He was also a Nazi. Why cite him and pick up his theory if my citational politics are about reproducing good relations in knowledge production? Good question. It's not because "who else could I possibly cite?" I cite Heidegger to demonstrate that even anti-Semitic, white supremacist, Nazi, canonized European thinkers not only are well aware of colonial land relations but also can see them with great clarity and nuance. I do this to argue against theories of change that rely on awareness as the crux of motivation for change. "If only settlers and colonialists *knew* how their worldview centers themselves and their needs against others'! If only they were *aware* of their privilege. If only they *understood* their own colonial relations with the world." Heidegger shows: they understand. Paraphrasing Eve Tuck: "Ask ourselves: what if settlers knowing didn't change anything? What if we didn't wait for others to know and were inspired by our own knowing?" This is why I quote Heidegger. And now we never have to deal with him again.

For a prolonged analysis that reads Heidegger and Vine Deloria Jr. (Standing Rock Sioux) together and in the end finds that Deloria does everything Heidegger does but better, with more flair, and without being tied to Nature (or Nazis), see Duarte, *Network*

serve."[87] He writes that creating a resource begins with "enframing," an act where "the energy concealed in nature is unlocked, what is unlocked is transformed, what is transformed is stored up, what is stored up is, in turn, distributed, and what is distributed is switched about ever anew. Unlocking, transforming, storing, distributing, and switching about are ways of revealing. But the revealing never simply comes to an end. . . . Everywhere, everything is ordered to stand by, to be immediately at hand, indeed to stand there just so that it may be on call for further ordering."[88] Heidegger calls the constantly deferred result of enframing the creation of a "standing reserve." He argues that modern technology's main task is to transform and stockpile Nature as a standing reserve via enframing. To paraphrase, this process makes the various relations of Land into a unidirectional relation called Resource for anticipated settler use. He illustrates his theory with the example of coal mining: coal is dug out of the ground not to be present as coal, but to be stockpiled and used at an unforeseen but anticipated occasion.[89]

The transformation of Land into Resource is achieved not only through the

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Sovereignty; and Tuck, "Research on Our Own Terms." For notes on Tuck's lecture, which was not recorded, see M. Liboiron, "'Research on Our Own Terms' by Eve Tuck." For more on some problems with theories of change based on awareness, see M. Liboiron, "Against Awareness, for Scale."

87 Heidegger, *Question concerning Technology*.

88 Heidegger, *Question concerning Technology*, 16–17.

89 Heidegger, *Question concerning Technology*, 15. In case you are a Marxist geek (hello!), *standing reserve* is a model of constant circulation and deferment, which is also the role of capital in capitalism. In *Capital*, Karl Marx (unmarked) expresses the basic activity of capitalism in the formula M-C-M′ (money [M] buys materials to make a commodity [C] to be sold to make more money [M′]). It is a form whose end is to procure surplus and nothing but surplus. The commodity, whether a manufactured item or a sink for pollution (which we will discuss in a moment), is merely a placeholder and transitory state for increased value for unspecified but eagerly anticipated ends (M-C-M′-C-M″-C-M‴). Marx, like Heidegger, finds the material perfection of this activity in modern technology. He writes, "In the large-scale production created by machines, any relationship of the product to the direct requirements of the producer disappears, as does any immediate use value. The form of production and the circumstances in which production takes place are so arranged that it is only produced as a vehicle for value, its use value being only a condition for this." Marx, *Capital*, 374. Capitalism and colonialism make such friendly bedfellows in part because of these analogous relational logics. Whether it is coal in the form of a standing reserve, a commodity as a placeholder for profit, or assimilative capacity as a sink for future pollution, the model of capitalism and imperialism is one of incessant increase and expansion for settler futures, both of which require access to Land.

arrangement of space but also through the arrangement of time. The temporality of Resource is anticipatory—it makes and even aims to guarantee colonial futures.[90] Crucial to this temporality is the belief that this future can be chosen and that the present can be directed toward it via management practices.[91] As such, Resources eclipse other possible relations with Land both now and in the future. The future is reserved for settler goals, colonized in advance. The landscape cannot support other relations, activities, or futures that might interfere with future use. If a river is for waste assimilation, it can only be a fishing spot if those activities do not preclude its role as a sink.[92] Fostering some futures and eclipsing others is a key technique of the managerial ontologies that characterize Resources and pollution. Risk management, disaster plans, homeland security (and other securities)[93] all share managerial ontologies dedicated to containing time for chosen futures.

> *One method for detecting plastics in biota such as mussels is to dissolve them in KOH (potassium hydroxide). One of my students wanted to use it for her thesis—it speeds up the process considerably, since instead of dissecting fish guts and spending hours staring over a sieve, you put the guts in a jar in an incubator and come back a week later to nothing but clear liquid, a bit of fatty residue, and some nice floating plastics. Sure, I said. As I ordered her supplies and went through university protocols for hazardous materials, I began to realize how toxic KOH was. For the first time in CLEAR's history, we*

90 For more on this concept of a guaranteed future (a.k.a. security) and how it's a primary framework for state exceptionalism and violence, see Masco, "Interrogating the Threat"; and Masco, *Theater of Operations*. For more on white, settler colonial temporality as a concept within this framework, see Mawani, "Law as Temporality"; Mitchell and Chaudhury, "Worlding beyond 'the' 'End' of 'the World'"; Rifkin, *Beyond Settler Time*; Veracini, *Settler Colonial Present*; and Strakosch and Macoun, "Vanishing Endpoint of Settler Colonialism."

91 The failures of these anticipatory tactics are discussed in such books as Bavington, *Managed Annihilation*; and Scott, *Seeing like a State*.

92 Phelps participated in debates about defining pollution according to the use of the water: "Pure water has been defined as a water that contains no harmful or deleterious substances with respect to the purpose for which it is to be used. In accordance with this very practical definition typhoid germs constitute an impurity and calcium salts do not in the case of a drinking water supply, while the reverse is true in the case of a boiler water." Phelps, "Stream Pollution," 928. What is interesting about these debates is how they deal (and specifically fail to deal) with a hierarchy of uses that implicitly ensures that industry uses are always possible.

93 Masco, *Theater of Operations*.

had to order hazardous waste containers and, when they were full, pay for them to go . . . somewhere. I was surprised by how easy it was to just get rid of the waste—just fill out a form and call a guy. Bam! Gone! (Somewhere!) It seemed antithetical to create hazardous waste as a lab dedicated to mitigating pollution. Worse, it was rude to dissolve our relatives and have them leave the lab as hazardous froth.

When I say that colonialism means ongoing settler access to Land for settler goals, this includes access to futures. Settlers do not have to set foot on the Land, own the Land, or even use the Land as a Resource so long as the Land is available for settler futures. You can just order KOH whenever you want, because the infrastructure anticipates its use and disposal as hazardous waste.[94] You can also choose not to, but Land is still arranged as a standing reserve, just in case you change your mind. In this way, a seemingly simple and certainly common scientific research method that produces hazardous waste is involved in colonial Land relations, even though its users are also likely invested in environmental goods and perhaps see themselves as Indigenous allies—or are Indigenous scientists themselves. Colonialism is not an event, not an intent. It is "not even a structure, but a milieu or active set of relations that we can push on, move around in, and redo from moment to moment."[95]

Property

Pollution is a property right. In *The Colonial Lives of Property*, Brenna Bhandar (unmarked) describes property ownership as "a bundle of rights that can be rearranged and redistributed depending on the social and political norms that legislators aim to promote. . . . The degree to which each of these rights is protected varies; the 'stringency' with which each of these rights in the bundle, such as the right to use, possess, exclude, devise, alienate, etc., can be understood

94 Based on the KOH issue, I made a new guideline for the lab: no processes that necessitate hazardous waste. It means we cannot study bivalves, crustaceans, and other invertebrates for plastic ingestion since KOH is the only way to "dissect" them. I gladly take up the restriction. Though now that's getting complicated as my Inuit colleagues want to study plastics in bivalves in their traditional food webs. Colonial technologies used for Inuit goals are . . . ? What? Not colonialism, but we still have a problem. To be continued . . .

95 King, *Black Shoals*, 40. For an excellent summary of the problems with White settler studies of colonialism, including Wolfe's perpetually quoted bit that "colonialism is a structure," see the second part of chapter 1 in King, *Black Shoals*.

as existing in a hierarchy whereby some rights . . . are more powerful than others."[96] This hierarchy is codified in most environmental regulations: "It is legal for some pollution to occur under Canadian and U.S. environmental law. Under the permission-to-pollute system in Canada, some effluents can be released to a certain amount, and spills and leaks are considered acceptable risks even though they happen regularly. . . . [This right supersedes] the United Nations Declaration of the Rights of Indigenous People and the right to free, prior and informed consent. This includes consent to be polluted or not."[97]

Under current settler state laws in Canada and the United States, the twinned values of appropriation and possessiveness allow different acts of pollution to make logical and even moral sense. The Foundation for Economic Education, a libertarian think tank, teaches, "If I deliberately pipe sewage into a pond on my own land, presumably I consider using the pond as a cesspool to be its optimum use. Hence, there is no abuse, no pollution. If however, either purposely or inadvertently I allow my sewage to flow into a neighbor's pond, against his [*sic*] will, I am without question polluting. I am lowering the value of his [*sic*] property."[98] In short, land is pollutable (so pollutable it can barely be considered pollution!) because a property owner has designated its pollution a best use, but only to the point that it would not infringe on another landowner's right to appropriation and possession.

In 1919, before he had provided empirical evidence for the threshold theory of pollution, Phelps wrote,

> It is good law as well as good economics that a riparian owner is entitled by right to any proper use of the stream that flows by his land, with due regard to the exercise of a similar right on the part of lower riparian users. This dictum of the common law has been interpreted by the courts in some extreme instances to mean that there shall be no appreciable reduction in the flow or alteration in the quality of the water by any user. Such extreme interpretation, however, would of itself defeat the very purpose of the law by prohibiting almost every valuable use of the water.[99]

For Phelps, use was paramount to defining pollution. In his mind, water was a Natural sink.

Yet specific uses did not matter as much as *access* to water for those uses. That

96 Bhandar, *Colonial Lives of Property*, 19–20. Also see Underkuffler, *Idea of Property*.

97 CLEAR and EDAction, "Pollution Is Colonialism."

98 Cooley, "Pollution and Property."

99 Phelps, "Stream Pollution," 928.

is, access to land for settler goals guided his convictions about pollution and resource. Tuck and McKenzie write, "The most important aim of recasting land as property is to make it ahistorical in order to hack away the narratives that invoke prior claims and thus reaffirm the myth of *terra nullius*,"[100] allowing settlers to think of their uses of land, for pollution or otherwise, as proper and right because it belongs to them and their goals and futures, whether individual or collective.

This is not an abstract claim. I cannot overemphasize how assumed access to land is foundational to so many settler relations. Land relations are central not only to Indigenous worlds, but also to settler worlds. To illustrate this with an example about research itself, the following story is by Lauren Watwood (settler), an anthropology master's student who is using CLEAR as a "field site"[101] for her ethnographic research. The story is from her first full day in the lab:

> *Tuesday morning. I'm sitting in the lab. My mind voraciously cataloguing every interaction, every gesture, every idea discussed as I listen to Max efficiently plow through Natasha, Kaitlyn, and Charlotte's list of items to be discussed. "My, my." I think to myself. "I am doing quite a good job being an anthropologist! Mhhmm. Look at all this gold I've already collected." After logistics are attended to, Max settles down in a chair to my left.*
>
> *"OK, what do we need to talk about?" she asks. I say, "Let's discuss our expectations for what I am doing here at the lab." We chat for a few moments and she innocuously asks, "Have you already been collecting data?" Proud of myself and my anthropological ways, I reply, "Yes, I have!"*
>
> *She replies calmly, deadpan: "That's stealing."*
>
> *My brain goes blank. I can't comprehend what she said. I recognize the words to be English, my mother tongue. . . . Yet, I don't understand what they mean in this context.*
>
> *"That's stealing," Max reiterates, likely repeating her words in response to my utterly vacant face. "You came in assuming entitlement to extract data and acted in a deeply colonial, imperialist manner. You thought you could come in here and take information from us without our consent, even after we've talked about needing to have a consent process in place. That's harm-*

100 Tuck and McKenzie, *Place in Research*, 64.

101 Where CLEAR does most of our research, in Labrador, *fieldwork* or *field site* are dirty words. They imply an outside, a Natural wilderness, a terra nullius ready for scientific discovery by settler academics, when in fact these places are homelands, homes, and houses. CLEAR is also a house and a home. While I have heard many people say this, I have never found someone write about it in a document. If you find something, please send it along. Maarsi.

ful." Her delivery of this news was not overtly aggressive, nor accusatory. She was simply explaining the fact of the matter.

"No!" I think, grasping for words that would make her understand. "No! No, not at all! I'm not stealing! I'm doing research!" I screech in my mind, the words clawing to escape my throat, so Max will understand. Please, understand. I wasn't ready to concede that what I had said and done was wrong or was out of alignment or was unethical. Because I couldn't think straight. I felt like I was being attacked and was terrified and pissed and defensive and upset.

Later, I realize: I claimed what wasn't mine to claim and never once questioned my methods. That is colonialism.[102]

To her credit, Lauren looked composed during this exchange, even if her eyes were a little big. When I told her she had to apologize to the lab and see what the lab collective wanted to do with the data she had already collected, she went off and crafted an apology,[103] presented it at a lab meeting a couple of hours later, and was welcomed into the lab. Dominant science, and research in general, plays multiple roles in colonial practices of settler access to Land under the logics of property and Resource.

Streeter and Phelps's work was paramount in abstracting Land into quantified and codified entities like assimilative capacity that could then be used to regulate industry's access to Land for effluents so rivers could be used—but not overused—to their fullest extent. Their scientific contribution was to coordinate access, not question it. This propertied, colonial orientation to research continues today, as Lauren discovered.[104]

102 Thank you, Lauren, for allowing me to share this story. As we've discussed in the lab, great, big, charismatic, obvious, event-based, well-witnessed mistakes are gifts to the lab if we work through them. Others in the lab have made similar choices, but they might have been harder to recognize. Your story gives us collective insights into the ways colonialism orients us to relations, regardless of intent.

103 Apology is a key relational method in feminist and anticolonial science IMHO. CLEAR's lab book has a section on apologies, since they're needed in any space where we're trying to unlearn colonial ways of knowing and after a few events that required apology, it turns out no one knew how to do a good job of it. The most up-to-date CLEAR lab book is on our website: https://civiclaboratory.nl.

104 Today is March 23, 2020: I am working from home in self-isolation during a COVID-19 state of emergency in my province (and the world). Researchers continue to go to campus to do research, even though we have shut down labs, asked all personnel that is not critical to go home, and cancelled all "fieldwork" and travel. Still, the entitlement to access space for research and settler goals is strong, even in the face of a collective pandemic. It's amazing/what-the-actual-fuck.

Maximum Use

Streeter didn't advocate for just any kind of Resource relation—he advocated for "*maximum* advantageous use of the streams."[105] Building on the work of Streeter and Phelps, in 1950 the chairman of the Department of Public Health Statistics at the University of Michigan, C. J. Velz, wrote a treatise on the importance of precisely calculating assimilative capacity so as "to take *fullest* advantage of the inherent resources available" in rivers as sinks. His concern was that "natural purification capacity is not being *fully* utilized,"[106] particularly during seasonal events that swelled rivers with extra water. In response, he perfected the sigmoid curve introduced by Streeter and Phelps. No water was to be wasted that was not adding to assimilative capacity!

Economic geographer Morgan Robertson (unmarked) writes that such mathematics were part of "creating a world in which we [settlers] see ourselves as utility-maximising and self-interested, or of rendering the entirety of the biophysical world as classifications and functions, [which occurs] through rather mundane and incomplete acts of reduction and simplification."[107] Extending this, anthropologist Elizabeth Povinelli (unmarked) writes about how colonists encounter forms of life (including L/land) that are not organized on the basis of market values as irrelevant, as irrational, and even as security risks.[108] Today, the logics, techniques, and infrastructures (in forms from pipelines to policy) of maximum use of sinks uphold land as something that is not only pollutable, but properly so.

The Morality of Property

Maximum use has a morality. Using a Resource to its maximum potential is good; to squander it is bad. Philosopher John Locke (unmarked) says so: "Land that is left wholly to Nature, that hath no improvement of Pasturage, Tillage, or Planting, is called, as indeed it is, wast [*sic*]; and we shall find the benefit of it amounts to little more than nothing."[109] A lot of Europeans were into Locke, and the legacy of those ideas is strong today.

In his work on the British privatization of common land and its relationships

105 Phelps, "Stream Pollution," 928; emphasis added.
106 Velz, "Utilization of Natural Purification Capacity in Sewage and Industrial Waste Disposal," 1608; emphasis added.
107 Robertson, "Measurement and Alienation," 397.
108 Povinelli, *Economies of Abandonment*.
109 Locke, *Two Treatises of Government*, 40.

to concepts of waste and wasting, geographer Jesse Goldstein (unmarked) outlines how land that was being used as a commons but not as a Resource became "a landscape of wasted potential" that specifically wasted "the improvers' economic right—presented as a natural right—to realize the maximum productive potential of all things, at all times, and in all ways."[110] When British peasants "failed" to extract maximum value from a shared landscape, they were removed, the land was enclosed and privatized, and the peasants were reintroduced to the enclosures as wage labourers on newly Resource-rich land. Goldstein argues, "Enclosure was a transformation from one moral conception of value to another."[111] More "than a particular historic technique of land reform in feudal England, and more than a collection of individual acts of theft or an uneven distribution of land and resources," dispossession and enclosure of land as Resource is "a general way of seeing the world" based on "a particular (and persistent) logic of expropriation, produced in and as part of the land itself."[112]

The logic of maximum extraction of value was at work not just in Britain, but also in its colonies. There, the moral imperative to improve land, to rearrange Land into Nature and Nature into Resource, was a primary (though not the only) refrain for dispossessing Indigenous peoples from their Land. Mishuana Goeman (Tonawanda Band of Seneca) contends, "property, as has been argued by Indigenous scholars and their allies, is distinctly a European notion that locks together (pun intended) labor, land, and conquest. Without labor to tame the land, it is closely assigned the designation 'nature' or 'wilderness.'"[113]

110 Goldstein, "Terra Economica," 360, 369. For more on enclosure, see De Angelis, "Marx and Primitive Accumulation."

For Métis, this story of enclosure probably sounds familiar. It's the mode of dispossession used in the scrip system via the Dominion Lands Act of 1879, the largest Land fraud scam in Canadian history. More than just a colonial way of seeing the world, the scrip system was a deliberate strategy of Land theft and genocide that worked in a myriad of ways, including turning Land into property parcels, addressing Métis as individuals rather than as a collective culture, and creating bureaucratic systems of land tenure that were impossible to maneuver legally and ripe for fraud. To compound this theft, surveyors and others dispossessed Métis of Land by stealing the scrip coupons themselves. If you're unfamiliar with the scrip system, especially if you are in Canada, you should know that this story is part of the truth part of truth and reconciliation. Here's a primer: CBC Radio, "From Scrip to Road Allowances"; Tough and McGregor, "'The Rights to the Land May Be Transferred'"; Adese, "'R' Is for Métis"; and Andersen, *Métis*.

111 Goldstein, "Terra Economica," 372.

112 Goldstein, "Terra Economica," 372.

113 Goeman, "Land as Life," 77.

Tiffany Lethabo King (Black) agrees, writing that "within this Lockean formulation, Indigenous subjects who do not labor across the land fail to turn the land into property and thus fail to turn themselves into proper human subjects."[114] Civilization and its opposite become identified with land use aligned with creating standing reserve to procure maximum economic value.

In 1876, an Indian reserve commissioner on Vancouver Island in the region currently known as Canada addressed members of "a Native audience" (Nation unspecified), who were being moved to reserves that were a fraction of the size of their previous Land bases. He explained, "The Land was of no value to you. The trees were of no value to you. The Coal was of no value to you. The white man came he improved the land you can follow his [*sic*] example."[115] This settler commissioner, along with many of his contemporaries, thought "that until Europeans arrived, most of the land was waste, or, where native people were obviously using it, that their uses were inadequate."[116] The virtue of "good use" "functions as a usable property to dispossess Indigenous peoples from the ground of moral value"[117] through an "ideology of improvement that privileges European forms of cultivation as proof of ownership."[118] This is only possible when there is *one* right land relation, accomplished via universalism.

In *A Third University Is Possible*, la paperson writes, "Property law is a settler colonial technology. The weapons that enforce it, the knowledge institutions that legitimize it, the financial institutions that operationalize it, are also technologies. Like all technologies, they evolve and spread,"[119] in this case to pollution via modern environmental sciences.[120]

Plastic's Moral Economy

One of the most popularized studies on plastic pollution is titled "Plastic Waste Inputs from Land into the Ocean."[121] Perhaps you know it better from its claim

114 King, *Black Shoals*, 23.

115 Cited in Cole Harris, *Making Native Space*, 108; capitalization of *Land* in original.

116 Cole Harris, "How Did Colonialism Dispossess?," 170.

117 Moreton-Robinson, *White Possessive*, 176. Also see Nicoll, "Indigenous Sovereignty and the Violence of Perspective."

118 Bhandar, *Colonial Lives of Property*, 10.

119 paperson, *A Third University Is Possible*, 4.

120 What I do not cover here is how pollution is also used as a technique to dispossess, even when logics of cultivation and sinks are not at play. For work in this area, see Johnson, "Fearful Symmetry of Arctic Climate Change"; Perreault, "Dispossession by Accumulation?"; and Stamatopoulou-Robbins, "Uncertain Climate in Risky Times."

121 Jambeck et al., "Plastic Waste Inputs."

that "the majority of plastic enters the ocean . . . from just five rapidly growing economies—China, Indonesia, the Philippines, Thailand, and Vietnam."[122] The media really loved it, and it circulated extensively. The research aimed to estimate the amount of postconsumer plastics (not industrial plastics)[123] entering oceans through a model based on population density along a country's coastline, the amount of plastic waste generated within that country expressed in per capita figures,[124] and the percentage of "mismanaged" waste in that country. In the paper, *mismanaged waste* is defined as "material that is either littered or inadequately disposed. Inadequately disposed waste is not formally managed and includes disposal in dumps or open, uncontrolled landfills, where it is not fully contained . . . plus 2% littering."[125]

It is not clear how the authors of the study compiled these numbers.[126] The

122 Jambeck et al., "Plastic Waste Inputs," 771.

123 Postconsumer waste (waste flows that start after items are purchased in the consumer market) accounts for only one area of marine plastics. Nurdles, or industrial production pellets, are regularly found in the ocean, and the model does not account for industrial and manufacturing-scale waste from production, transport, and construction. There are two problems with this. First, the only positive, intentional, large-scale change in marine plastic pollution trends is the global reduction of nurdles that occurred between the 1970s and today, likely due to industry response to early plastic reports. This means that one of the only available success stories about marine plastics is rarely told. Second, reports like these reproduce the erroneous truism that plastic pollution is a consumer problem rather than an industrial production problem. For more on how this framing is not unique to plastics but rather common to other environmental framings of waste generally, see Lepawsky, *Reassembling Rubbish*. Thank you, Josh (white settler), for your intellectual comradery and the generosity of your careful thinking and simple yet consistent ethics. One of the intellectual joys of working in Newfoundland has been to think with you about waste, especially on the thorny issues of Mary Douglas, scale, and action. Thank you especially for your humility, commitment, and carefulness in these discussions, and knowing where you ought to pick up lessons on your own. It is a privilege to work alongside you.

124 Per capita waste measurements erase both the role of industry in creating disposables as well as inequities in wealth that impact how waste flows through households and regions. They are made by taking the total amount of municipal waste recorded for a region, then dividing that number by the population of the region. They are an intense flattening of difference. For more on the justice problems of per capita waste measurements, see M. Liboiron, "Politics of Measurement."

125 Jambeck et al., "Plastic Waste Inputs," 756, 769.

126 There is no record of the raw data, the types of data, the categories of data, its sources, or its analysis. The report does note that there are several uncertainties in the data, including "relatively few measurements of waste generation, characterization, collection, and disposal, especially outside of urban centers. Even where data was available, methodologies were not

countries with the highest "mismanaged waste" figures are also countries most likely to have high data uncertainty. North Korea, for example, has a 90 percent "mismanagement" rate, a number that may well reflect a lack of public reporting practices rather than waste practices. Regardless, the category of mismanaged waste includes dumps (rather than landfills), informal recycling (rather than municipal recycling), reuse and repair sectors, and waste that is not managed at all: basically, deviations from American styles of land use and waste management. Another way to interpret the figures is that the countries listed are those that least resemble the United States. Given these assumptions, it is not surprising that the model's projections have not held up. When they were tested in the Pearl River Delta in China, they overestimated plastic waste flowing into the marine environment by an order of magnitude.[127]

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always consistent, and some activities were not accounted for, such as illegal dumping (even in high-income countries) and ad hoc recycling or other informal waste collection (especially in low-income countries). In addition, we did not address international import and export of waste." Jambeck et al., "Plastic Waste Inputs," 770. The assumptions built into the parameters of the research design—per capita waste averaged across wealth disparities, population counts that similarly average out differences in waste practices, and the assumption that 50 kilometres of coastline, worldwide, means the same kind of thing—are gross estimations. It is simply impossible math, pure charisma. While the report does say that its goal is to calculate plastic waste numbers in terms of orders of magnitude rather than with any kind of precision or accuracy, it also produced a map that assigns responsibility for global plastic pollution (below I will also note that the estimates have proven incorrect by orders of magnitude). The math accomplishes the universalizing of difference, context, and history to a shockingly high level, even for science. The lead author on the paper, Jenna Jambeck (unmarked), has noted on her website, "We had to use country-level data to build out our framework—so we do indeed have a list of countries that are top contributors. And this has been getting a lot of attention so I want to be clear about how we think about this list—it is not about finger pointing." Jambeck, "Plastic Waste Inputs from Land." Yet this is almost exclusively how the paper has been used, not least because it accurately reflects how the paper is framed. This is another example of how colonialism is accomplished through science and statistics, not shitty intentions.

For more on colonialism and statistics, including resistance against colonial concepts and premises that are built into data, see Walter and Andersen, *Indigenous Statistics*. Also see anything by the excellent Desi Rodriguez-Lonebear, a leading force and a pathmaker for the next generation of Indigenous data scientists. E.g., Rodriguez-Lonebear, "Building a Data Revolution in Indian Country." Maarsi, Desi, for your work, your way of working (Ethics! Commitments! Humour! Brilliance!), and your collegiality. You are my hero.

127 Mai et al., "Riverine Microplastic Pollution in the Pearl River Delta, China." Modeled plastic outflow based on "mismanaged waste" was 91,000–170,000 tonnes per year, while the measured outflow was 2,400–3,800 tonnes per year.

There is a long history of judging a society's waste management as a proxy for its level of civilization. This discourse is fueled by dominant Western frameworks where "human beings, both at an early age individually, and in societies at 'less developed' phases of Civilisation, are profoundly coprophiliac. They love the sight and smell of their own wastes, or at any rate are not disgusted by them. But as Civilisation historically develops, these initial coprophiliac dispositions are brought under increasingly rigorous control, just as the child in the contemporary West is toilet-trained out of its initial lack of revulsion towards its own faeces."[128] In short, from a colonial point of view, models of waste management are tied to ideas about civilization (European self-portraiture) and morality.

The "rigorous control" of plastic wastes from a colonial perspective includes practices such as municipal curbside collection of trash and recyclables, industrial-scale recycling, and highly controlled and technical landfilling—the cultivation of a containment system based on assumed ontologies of separation. Historically, these models originate in US systems and standards. The sanitary landfill was invented in Fresno, California, in 1935, around the same time that Streeter and Phelps were trying to manage sinks on the Ohio River.[129] Practices of waste management that fall outside of this careful cultivation by containment are categorized as "mismanaged" by Jambeck and colleagues. Whether the focus is on agriculture or waste practices, "those who maintained subsistence modes of cultivation, for instance, [are] cast as in need of improvement through assimilation into a civilized (read English) population and ways of living."[130] They are in deficit and need to learn to manage better, or be managed.[131]

128 Inglis, "Dirt and Denigration," 212. This evolutionary model is central to some of Sigmund Freud's theories of development. Also see Chakrabarty, "Open Space/Public Place"; Desai, McFarlane, and Graham, "Politics of Open Defecation"; and Doron and Raja, "Cultural Politics of Shit."

129 Though metal and other scrap recycling is centuries old, curbside recycling of disposables began in the northeast United States in the 1960s and 1970s, with sponsorship from the container and beverage industries, to allow the continual outsourcing of waste disposal. The 1970s also saw the invention of the plastic beverage bottle (made of PET plastic) by DuPont, an American-based chemical company. Weird. Except it's not weird, as shown in Hawkins, "Performativity of Food Packaging"; Elmore, *Citizen Coke*; and Strasser, *Waste and Want*. For more context on the intersections of water and waste via plastic, see Pacheco-Vega, "(Re)Theorizing the Politics of Bottled Water," 658.

130 Bhandar, *Colonial Lives of Property*, 36.

131 The English word *cultivation* "comes from the Latin verb *colere*—to till, tend, or care for—cultivation is a term for social practice rooted in engagements with nonhuman nature." I bring this up because it is an example of the structural violence that care can accomplish. Moore, Kosek, and Pandian, introduction, 9.

The Jambeck study is cited heavily in the Ocean Conservancy's 2015 report, "Stemming the Tide: Land-Based Strategies for a Plastic-Free Ocean."[132] The report's key proposal is to burn 80 percent of the waste in coastal Asia—those countries listed in the Jambeck study—to mitigate marine plastic pollution. To help this happen, they advocate changing national laws to allow foreign companies to build incineration infrastructure in the region. This is the new-again face of waste colonialism.[133] Again, people do not have to be jerks to maintain and reproduce colonial relations—they can have benevolent environmental goals. They can be working to solve important scientific questions. If land relations are colonial, the solutions, initiatives, and studies that flow from those relations will also be colonial.

Producing Difference

The first time I presented the concept of pollution as colonialism, it was early 2018 and the Stanley verdict had just come down, like a ton of bricks, two days earlier. Saskatchewan farmer Gerald Stanley (settler) had been acquitted of any wrongdoing for shooting twenty-two-year-old Colten Boushie (Cree) in the back of the head for trespassing on private land in 2016. As I presented theories of colonialism, I felt sick to my stomach with rage, grief, repulsion, and helplessness. The ability to end the life of Indigenous people, Black people, and people of colour[134] for being on Land that is currently considered private property (or even common property such as sidewalks and city streets) follows similar logics as the right to pollute.[135] Pollution is about maintaining differentiation through

132 For writing against this kind of colonial management of plastic wastes, see GAIA Coalition, "Open Letter to Ocean Conservancy."

133 M. Liboiron, "Waste Colonialism." Also see Reed, "Toxic Colonialism"; Kone, "Pollution in Africa"; and Pratt, "Decreasing Dirty Dumping."

134 I know there are discussions about *BIPOC* as a collective term, and they are good discussions. I continue to use it because I think it does something similar to what LGBTQ2SAI+ does; it shows that there is diversity within a genre of people and we all know that some of the *Q*s are also 2*S*s and maybe *T*s, and that doesn't break the acronym. Also, historically these acronyms will keep shifting and evolving. When I was a kid there was only *L* and *G*. Now look at us! I anticipate a similar future for *BIPOC*.

135 Trying to remember when I first learned this lesson, and whom I might cite, I recall a children's song we would sing on the middle-school playground. The tune is set to settler Woody Guthrie's (unmarked) colonial anthem, "This Land Is My Land":
This land is my land,
This land ain't your land.

appropriation and access to land, about keeping it reserved for settler goals and unavailable for other Land relations. So, too, is shooting unarmed Black, Indigenous, and people of colour.

Activist-geographer Laura Pulido (Chicanix) writes, "Land is thoroughly saturated with racism. There are at least two primary land processes to consider: appropriation and access. Appropriation refers to the diverse ways that land was taken from native people, as previously mentioned. Once land was severed from native peoples and commodified, the question of access arose, which is deeply racialized. Numerous laws and practices reserved land ownership for whites."[136] Some of these practices, like Stanley's, include guns. Others use pipelines. Still others measure the velocity of the Ohio River. They all guarantee colonial and settler access to Land for colonial and settler goals. Aileen Moreton-Robinson (Geonpul, Quandamooka First Nation) contends that property is best understood as a measure of what the white settler is capable of claiming as their own.[137] Pollution and wasting (of Land, of life) does not just accrue value and right to access to whites and settlers. It *produces* whiteness and settlement. As law theorist Cheryl Harris (Black) has argued, "The right to use and enjoyment, the reputational value, the power to exclude, are all characteristics of whiteness shared by various forms of property. Whiteness is . . . an analogue of property,"[138] as it is a condition and producer of white subjectivities—proper, civilized citizens. For all people, "Our ontological relationship to land is a condition of our embodied subjectivity,"[139] whether that relationship is through private property, Resource, kin, or Land.

I got a shotgun,
And you ain't got one.
If you don't get off,
I'll blow your head off.
This land is private property.

136 Pulido, "Geographies of Race and Ethnicity II," 529.

137 Moreton-Robinson, "Problematics of Identity." Thank you, Aileen Moreton-Robinson, for your work. In addition to *The White Possessive*, your presentation at the Native American and Indigenous Studies Association (NAISA) about how Indigenous identity is also able to be possessed (via appropriation and access!) by settlers and whites, and your call to move politics beyond identity, has resonated for me personally, professionally, intellectually, and politically. Thank you.

138 Bhandar paraphrasing Harris in Bhandar, *Colonial Lives of Property*, 7, from Cheryl I. Harris, "Whiteness as Property."

139 Moreton-Robinson, *White Possessive*, 17.

I remember a Q&A session after Michelle Murphy (Métis) presented on colonialism and pollution at the Society for Social Studies of Science (4S), where she asserted that even breathing had become a threat to Black people, Indigenous people, and people of colour.[140] A white woman raised her hand and countered Murphy's arguments by saying she didn't feel threatened by breathing or pollution, even though both are ubiquitous. Rather than arguing against the point, the questioner proved it: breathing is only dangerous to some.[141]

Unevenness is a defining feature of pollution:

> Toxicity is produced by and reproductive of different orders of life. Here, we articulate harm as that which disrupts order and existing relations, while also showing that toxic harm also maintains systems, including those that produce inequity and sacrifice. Then, we turn to toxic politics—struggles pertaining to power focused on which forms of life are strained or extinguished while other forms reproduce and flourish. . . . More than just the contravention of an established order within a system, toxic harm can be understood *as the contravention of order at one scale and the reproduction of order at another*. [For example,] chronic low levels of arsenic in water interrupt the reproduction of fish but maintain the ability of mining companies to store mining tailings in open air mounds.[142]

Unevenness is not only a description of pollution and its harms, not only a side effect, and not remotely an accident: unevenness is an accomplishment of pollution. It is its goal.

The Basics

I began this chapter by saying we would start with the basics: Land, Nature, Resource, and Property. I've attempted to denaturalize how these terms are usually used so the land relations that allow them to make sense become apparent. I hope I've explained it so that when you're on a call with the federal government and someone says that we should set a quantifiable limit to plastics in an environment, you can know this is about enclosure, access, private property, and whiteness. You might choose to tell just a small part of the story—perhaps

140 Murphy, "What Can't a Body Do?"

141 E.g., T. Allen et al., "I Can't Breathe"; Dillon and Sze, "Police Powers and Particulate Matters"; Simmons, "Settler Atmospherics—Cultural Anthropology"; Pulido, "Geographies of Race and Ethnicity II"; and Choy, "Air's Substantiations."

142 M. Liboiron, Tironi, and Calvillo, "Toxic Politics," 333, 335; emphasis in original.

about universalism, or maybe about maximum use of sinks—so the scientists will understand without having to sit them down for days and days of stories. If you are reading this as an academic, expert, teacher, and/or storyteller, I think this is an important part of our jobs—discerning when to tell the whole story, when to tell parts, which parts to tell for which audiences, knowing that they interlock, but being able to pull the parts apart when needed.[143]

This chapter is about modern environmental pollution, but it has also been crafted as an invitation for you to look at the structuring logic of your own discipline and forms of knowledge creation to see what its land relations are, what might be colonial about it, and which naturalized and seemingly benign techniques grant access, moralize maximum use, universalize, separate, produce property, produce difference, maintain whiteness. If our methodological interventions do not address land relations, then they don't address colonialism—we just end up with another study on "mismanaged" waste and another Stanley verdict. Let's do better.

143 This technique is shown beautifully in Dimaline, *Marrow Thieves*.

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