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A Mend to the Metabolic Rift? The Promises (and Potential Pitfalls) of Biosolids Application on American Soils

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Introduction

We live in a time of ecological crisis, or what is known in Marxian theory as the *metabolic rift*—the disruption of the Earth's socioecological systems brought on by industrial capitalism (Foster 1999; see also Moore 2011). Recently, McKenzie Wark has proclaimed that we are in fact experiencing "a series of metabolic rifts, where one molecule after another is extracted by labor and technique to make things for humans, but the waste products don't return so that the cycle can renew itself" (2015: xiv).

Marx himself originally located this rift in the English soil. As the environmental sociologist John Bellamy Foster (1999) explains, Marx had studied the works of the chemist Justus von Liebig, who had identified declines in soil fertility driven by the removal of soil nutrients under capitalist agriculture and a neglect for their systematic restoration. In *Capital Volume 1*, Marx declared: "All progress in capitalist agriculture is a progress in the art, not only of robbing the worker, but of robbing the soil" (1979: 506). Later, in *Capital Volume 3*, he specifically lamented how human excrement, which was once a resource for agricultural fertilization, had become a source of pollution and waste:

> Excretions of consumption are of the greatest importance for agriculture. So far as their utilisation is concerned, there is an enormous waste of them in the capitalist economy. In London, for instance, they find no better use for the excretion of four and a half million human beings than pollute the Thames with it at heavy expense.
> Marx 1999: 69

Which is to say, Marx really pinpointed the metabolic rift in the modern treatment of human excrement.[1]

This chapter examines attempts in the United States to mend the metabolic rift and turn human excreta into a viable agricultural fertilizer once again. Currently, the US Environmental Protection Agency (EPA) estimates that more than 8 million dry tons of biosolids (i.e., treated sanitation sludge) are produced in the country annually, but only about half of that material is applied to land, and US Department of Agriculture (USDA)-certified organic farms are prohibited from using it (EPA 2019). While some researchers, sanitation engineers, and farmers view the use of biosolids as a beneficial model for fertilization on a planet of finite resources (Basta 1995; Cofie et al. 2005; Cordell et al. 2011), others have raised concerns about its possible consequences for public health, and some communities have even accused farmers of conspiring with the sanitation industry to spread "toxic sludge" on agricultural lands (Snyder 2005; LeBlanc et al. 2009). And, for the majority of Americans, the realities of sewage treatment and disposal remain largely hidden in plain sight. As Gay Hawkins argues, the hydraulic sanitation system is a "public secret," aided by modernist infrastructure that blinds people from knowing "where shit ends up" (2002: 40).

This chapter relies on participant observation and semi-structured interviews ($n = 26$) conducted in 2017 and 2018 with wastewater treatment specialists, soil scientists, and grain farmers in three sites in the United States—Ohio, Illinois, and Washington State. Through this ethnographic research, I explore the contemporary regulation, production, and application of biosolids. Specifically, I highlight different experts' insights into the productive benefits of biosolids, including the remediation of degraded industrial sites, the return of nutrients to agricultural lands, and the incorporation of much-needed organic matter into soils vulnerable to erosion. However, I also bring attention to the emergent concerns facing contemporary sanitation systems, from unregulated industrial chemicals in the waste stream to public fears regarding the application of biosolids on rural lands. In doing so, I question the extent to which the growing movement to adopt biosolids in industrial agricultural production reflects either a trend of "salvage accumulation" (Tsing 2015)—the amassment of wealth in the ruins of late industrialism—or a new, albeit uncertain, frontier for ecological sustainability in the Anthropocene. To conclude, I offer reflections on the challenges of sustainable agricultural management under late industrialism (Fortun 2014). Ultimately, I contend that while the use of biosolids is proving effective in various sites in the United States, the increasing complexity of late industrial excreta (see Blanchette 2019) should draw our attention to the problematic practices and pollutants further upstream from biosolids processing rather than fixate solely on the endpoint of their application.

Background: From Agricultural Resource to Human Waste (and Back Again)

Prior to the development of the modern hydraulic sanitation system, people across the world commonly relied on human excrement as a source of agricultural fertilization, sometimes known euphemistically as "night soil" (Kawa 2016). An extensive history of this practice can be found in the Americas (see, for example, Becerril and Jiménez 2007; Birk et al. 2011), Africa (Van Der Geest 2002; Cofie et al. 2005), Europe (Gandy 2004), and Asia (Hanley 1987; McNeill and Winiwarter 2004; Xue 2005). The earliest document describing the application of night soil as a fertilizer appears in *Qi Min Yao Shu*, the first Chinese agricultural instruction book, written between 553 and 554 AD

(Jia and Huang 1977). During the Qing dynasty (1736–95 AD), night soil grew into such a prized agricultural resource that farmers not only sought out night soil for fertilization of their fields, but many also became involved in its sale and trade, traveling long distances to procure high-quality night soil (i.e., high in nitrogen and other nutrients) from wealthy, urban areas that had protein-rich diets (Xue 2005). Night soil depots or trading houses (*fenchang*) were even established to handle the collection, transport, treatment, and sale of night soil, with many farmers eventually abandoning their agricultural work in the late nineteenth and early twentieth century to become night soil traders instead. Until the 1970s, urban toilet cleaners still paid for the night soil they collected from residents' houses in southern Chinese provinces like Jiangnan (Xue 2005). By the mid to late twentieth century, however, the rise in adoption of chemical fertilizer along with growing concerns regarding night soil's role in the spread of diseases (see Kim et al. 2014) led to a drastic reduction in its use in Asia (Ferguson 2014). The large-scale abandonment of night soil in China mirrored a similar trend witnessed in Europe and North America nearly a century earlier.

Before the development of the modern hydraulic sanitation system, most European cities like London relied on night soil collectors to remove excrement from cesspits and privies. As in Asia, night soil was collected and then spread on agricultural fields in the rural countryside. With the growth in popularity of the flush toilet in the mid-nineteenth century, however, private toilets directed increasing volumes of water into urban cesspits, which considerably diluted night soil and diminished its value for agricultural application (Gandy 2004: 366). To complicate matters, the expansion of cities pushed night soil collectors greater distances to reach their markets in rural areas—not to mention that the cost of emptying a cesspit was double the daily wage of an average skilled laborer, which presented an additional obstacle to timely removal (Johnson 2006: 10). Together, these factors created the conditions for bacteriological disaster—between 1831 and 1866, Britain was ravaged by four distinct cholera epidemics due to the contamination of drinking wells.

At the time, there was much debate in Europe over the flushing of human feces into newly constructed sewer systems that were originally designed to handle urban storm water and that alone. Despite such debate, the idea of channeling human excrement into city sewers became the most practical option, especially since running water was not believed to be at serious risk of contamination (Benidickson 2011: 4). The model of the private flush toilet encouraged this "culture of flushing," sending urban wastes into underground tunnels and off into rivers and the open oceans. And so, the modern hydraulic sanitation system was born.

The spread of disease from feces leaking into drinking water is what spurred the adoption of the modern sanitation system, but it never fully addressed the problem of keeping human excrement out of water. Instead, it largely attempted to resolve it by flushing it further downstream, where it would become someone else's problem. For this reason, by the end of the nineteenth century and beginning of the twentieth, sewage treatment became the focus of intensive scientific inquiry (Schneider 2011). Some European cities, including Paris and Berlin, relied on "sewage farms"—open fields where urban excreta were applied—but the extensive tracts of land needed to sustain such operations led to alternative methods (Schneider 2011: 13). In the early twentieth century, a critical breakthrough occurred with the invention of the "activated sludge method." Under this new process, sewage was placed in aeration tanks with large populations of bacteria. As Daniel Schneider explains:

> After treating the sewage for just a few hours, the bacteria-rich sludge was allowed to settle out, cleansing the sewage of solids and leaving a clear effluent. Like a sourdough starter, some of the settled sludge was added back into the aeration tank to treat new sewage. The engineering press quickly heralded the activated sludge process, and cities around the world began to experiment with it.
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> 2012: 172

But the problem still remained of what do with all the remaining residues.

American cities like Milwaukee and Chicago were quick to recognize the potential value of treated sludge as an agricultural amendment, and began to employ it as such. Many other metropolitan areas resorted to landfilling, incineration, or dumping into waterways. However, when the United States Congress passed the Clean Water Act in 1972 and then later the Ocean Dumping Ban Act in 1988, the disposal of sewage sludge into oceans and waterways was prohibited, and the use of sanitation sludge became more highly regulated (EPA 2019). As agronomists and soil scientists had argued before, the alternative solution appeared to be in the soil.

Biosolids: Their Regulation and Possibilities for Use on a "Damaged Planet"

The word "biosolids" was developed in the early 1990s by the Water Environment Federation as an attempt to rebrand sewage sludge and promote "beneficial use" of it, particularly as a soil amendment. The term was adopted by the US EPA in 1992, and it has stuck ever since. And there is a good reason for that: just say the word "biosolids" and let it hang in the air for a second or two. You can't even smell it, can you?

Part 503 of the United States Clean Water Act outlined the federal guidelines for the oversight and monitoring of agricultural use of sludge, including testing for nine heavy metals. Following those regulations, there are two distinguishable grades of biosolids: Class A and Class B (EPA 2019). In Class A biosolids, pathogens must be reduced to undetectable levels and strict standards are applied with regards to heavy metals and offensive odors. This class of biosolids can be applied to land without restrictions and is frequently sold as a fertilizer or compost to ordinary homeowners and gardeners. Many different US cities have marketed their own brands of Class A biosolids, including Milorganite from Milwaukee, TAGRO from Tacoma, Dillo Dirt from Austin, and Com-Til from Columbus.

In contrast, Class B biosolids undergo treatment and must meet the same regulations with regard to heavy metals, but they are allowed to contain marginal levels of detectable pathogens and odors. For this reason, they also require EPA permits for their use on agricultural lands. Still, many large-scale agricultural operations use Class B biosolids, particularly for the production of commodity crops like wheat, corn, and soy. Perhaps unsurprisingly, the use of Class B biosolids has generated the most public resistance.

While interviewing Tony,[2] an environmental chemist who has worked with biosolids across the United States for decades, I asked what he thought of the ongoing debates regarding the safety of using biosolids in agriculture. He admitted that at their onset, early biosolids might have had some "nasty stuff" in them. However, the EPA developed what he described as a "carrot-and-stick approach" by the early 1990s. "They said if you produce Class A biosolids, then the regulatory burden will be taken off your shoulders. If you don't, then we will regulate the hell out of you." And, according to Tony, it pretty much worked. Having studied metals in soils since the 1980s, all the biosolids are—in his words—"clean" today.

But what is more interesting, he added, is that while people are worried about all the things that end up in biosolids, they are often present at reduced amounts when compared to what people typically ingest or expose themselves to. Take triclosan, for example. Tony described it is a "pesticide," although I later found it to be identified as "an antimicrobial agent" (Bhargava and Leonard 1996). Regardless of its classification, it is a common ingredient in hand soap as well as toothpaste. Products like Colgate Total rely on triclosan to reduce plaque build-up on teeth, but it has also been shown to pose possible health risks—including disruption of sex and thyroid hormones (Zorrilla et al. 2009). Triclosan is also suspected to contribute to broader bacterial resistance and the rise of so-called "superbugs." Tony laughed as he described attending meetings in which wastewater treatment plant managers berated executives from the multinational consumer goods corporation Procter & Gamble, demanding they take antibacterial agents out of soaps and other products because they messed with the ability of microbes in wastewater aeration tanks to "do their job." Tony conceded that triclosan is usually "shredded up" pretty quickly by microbes in wastewater treatment facilities, but it invites one to wonder: what other chemicals might be found in the sanitation system that are not so easily eaten up?

Before meeting with Tony, I had naïvely thought of biosolids as treated human excreta that served as agricultural fertilizer. But that is not really the case. When human excrement is channeled into a wastewater treatment plant, it is devoured by microbes. The resulting byproducts are largely constituted by the remains of those microbial bodies—in fact, Tony told me that the biomass in sludge actually *increases* during the wastewater treatment process. And, even before raw sewage enters into treatment, it is already so much more than just human excrement.[3] For a minute, think about all the things that people might put down their drains or toilets besides water and excrement: toilet paper, tissues, tampons, toothpaste, dental floss, baby wipes, shampoo, shaving creams, soap suds, matches, ashes, pet snakes, solvents, slimes, fats, grease, goldfish, paints, condoms, bleach . . . the list goes on and on. This does not even account for all the refuse dumped by businesses and manufacturers. Although we know and understand this, it is only on rare occasions that we reflect upon all the unwanted things that are channeled into the sanitation system, much less how they might complicate attempts at "closing the loop" in agricultural systems, or address the widening metabolic rift.

In recent years, Tony has been developing research at the southernmost edges of the city of Chicago, where he and others are hoping to bio-remediate old slag heaps at abandoned industrial sites using biosolid blends. Planting native grass species into what he describes as a "biosolids dream treatment," he and his colleagues are seeking to build a different model of ecological restoration for a less-than-pristine world. Already, in several different areas of the eastern United States, old strip mines are being rehabilitated with deep row hybrid poplar plantations that are fertilized with biosolids (Felix et al. 2008). Trenches are dug into the denuded lands and large seams of biosolids are deposited before bare-root poplars are planted above. Over time, the root systems of the trees break through the rocky land, while drawing from the nutrient-rich biosolids. In six to nine years, the poplars can be harvested and made into mulch. Prior to their harvest, they can help rebuild the soil and reduce run-off from the site. While biosolids might not be perfect or "pure," Tony and others reason that they offer significant opportunities for reclaiming otherwise severely degraded lands.[4]

The edited volume *Arts of Living on a Damaged Planet* (Tsing et al. 2017) highlights the tensions inherent to such ventures as the ones undertaken by Tony and his colleagues in this time of ecological crisis. In the introduction to that volume, Elaine Gan and colleagues (2017) argue that today we are living in the midst of haunted landscapes that carry vestiges of past ways of life, including the ruins of an earlier industrial era and species now extinct. But, the authors note that present landscapes are simultaneously haunted by imagined futures and "dreamworlds of progress" (Gan et al. 2017: G2). By rehabilitating slag heaps and strip mines—wasted landscapes borne out of the modern industrial push for progress—it is difficult to discern whether the application of biosolids today represents an opportunity to make up for past mistakes, or instead serves to reinvigorate the same technoscientific optimism that will ultimately yield the same (toxic) results. Framed somewhat differently, one might ask: is the adoption of biosolids in ecological rehabilitation part of a new model for thinking about environmental sustainability on a damaged planet, or is it nothing more than an attempt to squeeze profit out of its accumulated ruins?

To understand the challenges of mending the metabolic rift today—and the role of biosolids in urban ecologies and contemporary agricultural production—I decided before venturing any further to look into the site of biosolids production in the city where I live.

Biosolids Production and the Problems of Purity

"It's not shit anymore," Rachel said plainly. We were driving through the facility where the City of Columbus produced its compost known as Com-Til, derived from treated sanitation sludge and wood mulch. It was the dead of winter and steam was rising off the piles as the thermophilic microbes did their work

I asked Rachel if the taboo surrounding human waste made Com-Til a difficult product to market. "Fifteen years ago, it was a harder sell. People have a foothold now," she told me. Part of this she attributed to interest in kombucha and probiotics. "There's a cultural swell," she said, "that's focusing more attention on the importance of healthy microbial populations both in our bodies and in the soils."

Figure 9.1 A pile of Com-Til—composted woodchips and biosolids from the City of Columbus, Ohio—releases steam as thermophilic microbes "do their work." Photo by Nick Kawa.

With the "intestine of the city," she told me, "we can create a story." The story that Rachel wanted people to understand is how microbiota circulate from bathrooms into the wastewater system to rendered sludge, then to Com-Til and then back to the soil, hopefully to make food. "Composting waste and using it for agriculture," Rachel continued on, "everyone is contributing to the cycle. YOU are helping close the carbon cycle, YOU are helping close the phosphorus cycle, YOU are helping close the potassium cycle." In this way, people can begin to see their role in this broader ecology, she insisted.

In 2017, the City of Columbus achieved 100% beneficial use of its sanitation sludge. Now, it directs biosolids into the compost program but also does liquid land application of Class B biosolids, working with large commodity-crop farmers. It also supports hybrid poplar production in eastern Ohio, and some of the sludge even goes to biodigestors for energy production. But Rachel added that there were still limits—both legal and cultural—to the acceptance and application of biosolids. "What kind of hurts my heart is that you can't sell this as an organic amendment." She shared that she had bought lots of organic food in the past, but she also saw how the vision of organic farming could become restrictive, especially in its obsession with—in her words—"its own purity."

"Does this have triclosan in it? Yes, probably it does. But," she argued, "organic farmers really have to hustle to get their needs met when it comes to building healthy organic matter in the soil." And Class A biosolids could be a way to do that, she indicated. But the concern over purity remained.

"Is it [Com-Til] pure? No. Is it pretty damn good? Yes," she insisted. "What's pure anyways? It's like a how-many-angels-on-the-head-of-a-pin question. If you take it from the perspective of 'what's our best option?', it's a pretty damn good option," Rachel concluded.

In her book *Against Purity*, Alexis Shotwell observes: "To be against purity is . . . not to be for pollution, harm, sickness, or premature death. It is to be against the rhetorical or conceptual attempt to delineate and delimit the world into something separable, disentangled, and homogenous" (2016: 15). Similarly, Rachel insinuated that the ideals of purity in organic agricultural production had their own dangers, or at the very least, they could stand in the way of pragmatic forms of sustainable resource management, including the use of biosolids as a soil amendment. More than just a source of fertilization, Rachel pointed out that biosolids could help return much-needed organic matter to soils that had suffered from erosion and even contribute to soil health by bolstering soil microbial populations. Her comments, along with those of contemporary social theorists like Shotwell, seemed to demand recognition that we live in a world that is deeply compromised, and yet that should not stop us from trying to make it more livable, despite the inevitable flaws in any of our designs. This also suggested that attempts to mend the metabolic rift should be stripped free of any romanticized notions about returning to a time of living in "equilibrium with nature." Clearly, the conditions of late industrialism are far different from those of only a few hundred years ago, and as such, they require negotiation with a whole series of different questions, concerns, and modern messes that are not so easily cleaned up or straightened out (Fortun 2014). Yes, triclosan and PFOAs and PCBs run through the waste stream, as do Viagra, Xanax, Prozac, Vicodin, and many other pharmaceuticals and personal care products that individuals consume and excrete. But with a growing ecological crisis before us, Rachel and many others working with biosolids reason that we simply cannot afford to hide from our waste anymore.

Back to the Land: Biosolids Application and Attempts to "Close the Loop"

To see what the use of biosolids could do on a large agricultural scale, Rachel had recommended that I visit the state of Washington where efforts to promote biosolids were—in her words—"years ahead" of the American Midwest. In August of 2017, when I happened to be traveling through Seattle, the King County Biosolids Program graciously offered to take me on a day-long tour of their operation in Mansfield (more than three hours away by car from Seattle), where they had been working with dryland wheat farmers for decades.

Amy from the program picked me up just before 6:00 am at a coffee shop on the outskirts of downtown Seattle. On our way out of town, I asked her about the emergent issues in biosolids that she had been tracking. She listed off bans in the northeastern United States and new concerns about PFOAs (perfluorooctanoic acids) in sludge.

There had also been attempts to ban biosolids in Kern County (southern California), but they ultimately failed. And, she said, there was a lot of controversy over biosolids in neighboring Canada.

In response, I asked Amy about what they had been doing to attempt to change public perception or bring attention to the beneficial use of biosolids. "We try to use more social media, but often get trolled online, and our partners do too, so it's kind of a disincentive to promote the work," she shared. But they also do other things. Currently, King County has an urban farm at a treatment site that relies strictly on biosolids for fertilization. The program also hosts a dinner during Seattle's Local Food Week with food produced with biosolids. But, in general, Amy observed that "hardcore gardeners are a lot more accepting" of biosolids than the populace at large.

After picking up three additional team members—James, Alan, and Susan—the team gave me a background on the history of the King County Biosolids Program. James informed that in the late 1980s, King County had wanted to diversify beyond the use of biosolids in forestry and hoped to find a location to do agricultural application. They held a public meeting in Grant County (eastern Washington State), and there one individual spoke up. He thought it wouldn't be right for him, but it might be useful to his brother. Not long after, the brother and two other men decided to give biosolids a shot—later, becoming known as "the Big Three" in the local farming community. They started with a 5,000-acre test plot of wheat, and that year it outperformed conventional fertilizer in total yield. Today, they and others work with biosolids on 100,000 acres of land, and more than 100 landowners are involved in all.

But despite their success, there is still resistance. In neighboring Lincoln County, some farmers at higher elevation—who produce mostly dryland grain crops—were interested in adopting biosolids, but organic fruit and vegetable farmers situated at lower elevations were "freaking out," James said. Nearby in Kittitas County, one citizen opposition group with the acronym CRAP even formed to protest biosolids use.

"You get resistance from the same four 'antis' [private citizens against biosolids] who always say that if you use biosolids the world is gonna end," Susan chimed in. One locally vocal critic was even caught trespassing at their operation in Mansfield, although they joked that they were happy to let him take some biosolids home with him. "He claims that Snoqualmie Pass Forest application is affecting Puget Sound forty miles out and that it's killing the rabbits!" Susan continued. "It's a 'toxic brew,' the antis all say!"

Despite the occasional outburst of the naysayers, 82% of biosolids are land applied in the state of Washington. In fact, biosolids are required to be directed to beneficial use in the state. Only in scenarios where land application is not possible does landfilling or incineration occur. Susan said that following the Clean Water Act, the state came to the realization that "what was toxic to a river was beneficial to land." But communicating this key point to the public was largely lost, she told me. In front of us, a truck carrying biosolids from Seattle suggestively advertised its product with the catchphrase "Turn your dirt around."

When we reached Mansfield, we joined up with Dan, who managed their operations there. He reiterated that there were over 100 landowners and farmers involved. Dan explained to me that dryland wheat is produced every other year (one year in production and one year left fallow). Best management practices dictate that the application of biosolids occurs only once every four years. The second crop in the rotation is often able to capture residual nitrogen from biosolids in the soil, he explained.

Switching gears, Dan acknowledged that there were still some landowners and farmers in the area who didn't want to get involved. "Some don't want it—they see the gremlins," he commented wryly. But there were also cases in which landowners convinced farmers renting their land to adopt it. To put it plainly, he said: "[If you] hate biosolids, [then you] don't want the money." In other words, Dan contended that farmers who avoided biosolids had missed an opportunity to increase the profitability of their operations.

Originally, King County paid farmers in the area fifteen dollars per acre to till biosolids into the soil. Since then, the initiative has grown, and farmers now pay for the fertilizer. Dan summarized: "It's all about the money for the farmers . . . especially for the younger, poorer farmers. The older guys [still] have some cookie jar money."

But it is also about more than just the economics. "Are there noticeable improvements to the tilth?" I asked. "Oh yeah," Dan responded, "especially the no-till guys. Lots of organics [soil organic matter], which is what they want." Over the last few decades, more and more American farmers have adopted no-till management as a soil conservation practice, which requires farmers to abstain from tilling the land to minimize soil disturbance and erosion. Dan said about half of those with whom they worked had gone to no-till, particularly as government subsidies were made available. Alan, the soil scientist on their team, shared that other research had shown that biosolids application could help increase carbon sequestration, particularly when applied in conjunction with continuous no-till management (Spargo et al. 2008). And Dan said that the application of biosolids appeared to boost soil microbial health, which helped to break down the stubble left from the previous cropping cycle when farmers practiced no-till.

Dan showed me a photo hanging on his office wall that was taken at a nearby farm. A strikingly clear line could be seen between the land that received biosolids application and land that did not. Dan explained that the field where biosolids were applied had no remaining wheat stubble from the previous cropping cycle, likely due to higher microbial activity in the soil, while the adjacent field still had rows of old wheat stalks waiting to decompose. "See, clear line between 'poop' and 'no poop,'" he joked. "I'm a salesman—you know a lie. But the plants don't lie to you."

Of course, biosolids surface application can present problems too. One of the primary concerns among farmers was soil compaction. With large spreaders used to haul and disperse dried biosolids across the land, the heavy machinery can compact the soils. This can compromise the soil structure by reducing pore space and limiting the overall soil volume. Compacted soils also require plants' roots to work harder to penetrate compacted layers. But Dan argued that the concerns over compaction were overblown and the economics of biosolids outweighed any downsides in the end. "What's the difference between a 747 [jet airplane] and a farmer?" Dan asked, flashing a grin. "The 747 quits whining when it gets to Hawai'i."

Near the end of our tour, Dan took us to a field where Class B biosolids were being applied. The land was dry and large dust storms had begun to kick up. "God only waters

Figure 9.2 A photograph that demonstrates the difference that biosolids application can make. Photo by Nick Kawa.

here every once in a while," he observed. Nearby, several different piles of biosolids were mounded up, each marked with a different sign that indicated a point of origin. For example, the city of Alderwood, a wealthy community in the Seattle metropolitan area, produced a high-quality Class A product, but because the city was not interested in marketing it independently, it was used in Mansfield along with the other Class B material. Most other cities, however, did not produce the same high-quality material. Dan informed that they worked with over thirty cities in Washington State, which each generated biosolids with distinct nutrient contents and qualities. For that reason, they were required to make calculations to determine the appropriate rate of application for each batch of biosolids. Four tons of biosolids from some cities could be equivalent to three tons of material from others in terms of total nitrogen. It quickly became apparent that not all biosolids were created equally.

On our last stop, flies swarmed around a particularly ripe pile of biosolids and then followed us back into Dan's suburban. As we swatted the flies, Dan acknowledged that between them and the dust, application was not always pretty. But, at least for him and many of the farmers in Mansfield, it seemed to be working well enough. And there was something to be said for that.

Figure 9.3 A large mound of Class B biosolids are hauled across a future dryland wheat field near Mansfield, Washington. Photo by Nick Kawa.

After leaving Washington, I wondered what Dan and the farmers of Mansfield might have to say about their work in relation to the metabolic rift. Did they see themselves as fighting back against the trends of soil degradation—including the mining of soil nutrients as well as the loss of topsoil—that began during industrialization? Or did they simply understand themselves as savvy businessmen capitalizing on an opportunity in an increasingly competitive agricultural market? Or perhaps they stood somewhere in between? My hosts from the King County Biosolids Program argued that the use of biosolids in the state of Washington is a win-win for farmers and their soils. By this they meant that farmers are able to take advantage of a soil amendment that not only offers macro- and micronutrients at an affordable cost but also contributes vital organic matter to soils otherwise prone to weathering and erosion. After visiting with Dan and others in Mansfield, it was hard not to see things from this vantage point. But part of me still had questions. And, yes, maybe even some doubts too.

Conclusions

Anthropological investigations into contemporary soil management—and the use of biosolids in particular—might not offer a clear vision for the future of sustainable agriculture in the United States, or elsewhere. However, such investigations can help to scrutinize the systems and resources that enable agricultural production under the conditions of late industrialism. The case of biosolids, for example, helps draw attention to the compromises that late industrialism demands between idealized models of sustainable agricultural management and more practical strategies that are accessible but plagued by uncertainties, including the long-term impacts of industrial compounds (from triclosan to PFOAs) on the microbiota that sustain agricultural lands.

Through my interviews and visits with wastewater treatment professionals, soil scientists, and others involved with biosolids production and application in Washington State and the American Midwest, I have come to see the expanding use of biosolids as encouraging productive futures for human "waste" by returning valuable nutrients and organic matter back to agricultural lands that have suffered from soil erosion, nutrient depletion, and losses in microbial health. However, it is also apparent that this soil amendment can open the door for a vast array of other substances and wastes—from chemical compounds in personal care products to residual pharmaceutical agents—to be redirected and concentrated in agricultural landscapes. At the end of 2018, the EPA released a report that reignited concerns surrounding the safety of biosolids (EPA 2018). The report highlighted 352 unregulated chemical compounds in the waste stream that can persist in biosolids and might ultimately pose some risks for environmental and public health. Because there are so many unknowns regarding the waste stream, there are just as many (if not more) concerning the treatment and application of biosolids. For now, the questions will remain.

Regardless of the ultimate fate of biosolids in American agriculture, more sustained and systematic examinations of the waste stream can have other important consequences for addressing the metabolic rift. If the potential value of human excrement as an agricultural resource is severely compromised by triclosan or PFOAs or other unregulated chemical compounds, then this may serve to amplify the problems posed by these toxicants that are already ubiquitous in the lives of consumers. In such a way, the anthropological study of soil and how we sustain it in under late industrialism can force a broader rethinking of industrial ecosystems and their management. If the current system does not allow for the viable production of agricultural fertilizer from bodily excreta (human or otherwise), then we should ask what conditions need to be in place to develop systems that can.

As Marx argued nearly 150 years ago, industrial capitalism turned human excrement from an agricultural resource into a source of waste. Ironically, biosolids may prove to be profitable under the conditions of late industrialism, but how they can be employed to reverse trends of the metabolic rift as outlined by Marxian scholars is a far greater challenge. Despite many unanswered questions lingering, there is a growing recognition that our bodily substances are necessary elements of our socioecological systems, and that we simply cannot hide from our waste anymore. Perhaps in learning to live with our wastes, we might come to more critically assess the broader industrial ecologies in which they circulate.

Notes

1 As noted in the Introduction, John Bellamy Foster (1999) was the first to explicitly articulate this notion of the metabolic rift. Since then, Jason W. Moore (2011) and many others have expanded this line of Marxian ecological thinking. However, Schneider and McMichael (2010) have critiqued the idea that the metabolic rift is solely rooted in the disruption of nutrient cycling from human bodies to agricultural lands. They note that some forms of capitalist agriculture could be deemed ecologically sustainable—such as eighteenth-century English high farming that relied on crop rotation with sheep manuring—even while they were socially exploitative. Conversely, there are many examples of precapitalist societies that practiced unsustainable forms of land use that mined nutrients from the soil. The point that Schneider and McMichael ultimately make is that agricultural practice itself demands consideration in any examination of the metabolic rift. In this chapter, I specifically focus on the use of human excreta as a source of fertilization in contemporary capitalist agriculture in the United States, but I also take into consideration the agricultural practices that enable its use.

2 The names of all individuals interviewed have been replaced with pseudonyms.

3 It is arguable whether human excreta is even largely "human," since it is mostly composed of diverse microbial bodies that inhabit the human gut. Walker and Granjou (2017) make this point explicit in their study of the European Space Agency program known as MELiSSA, which is working through the tricky problem of managing human "waste" in space along with all of the microbial bodies that thrive in the human gut.

4 Soil scientific research has shown that biosolids application can improve soil structure and soil porosity while also increasing soil organic carbon on degraded lands (García-Orenes et al. 2005; Tian et al. 2009). In New Mexico, a study by Aguilar and Loftin (1992) demonstrated that biosolids were more effective at restoring degraded rangelands suffering from soil erosion and nutrient depletion due to overgrazing than rangeland management through natural regeneration (i.e., by removing cattle). Biosolids have also been effective in land reclamation, particularly for reestablishing vegetation on lands degraded by extensive mining activity (Brown et al. 2003).

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