ARTICLES

Toxic Research

Political Ecologies and the Matter of Damage

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■ **ABSTRACT:** In a world saturated by toxic substances, the plight of exposed populations has figured prominently in a transdisciplinary body of work that we call political ecologies of toxics. This has, in turn, sparked concerns about the unintended consequences of what Eve Tuck calls “damage-centered research,” which can magnify the very harms it seeks to mitigate. Here, we examine what political ecologists have done to address these concerns. Beginning with work that links toxic harm to broader forces of dispossession and violence, we turn next to reckonings with the queerness, generativity, and even protectiveness of toxics. Together, these studies reveal how the fetishization of purity obscures complex forms of toxic entanglement, stigmatizes “polluted” bodies, and can thereby do as much harm as toxics themselves. We conclude by showing, in dialog with Tuck, how a range of collaborative methodologies (feminist, decolonial, Indigenous, and more-than-human) have advanced our understanding of toxic harm while repositioning research as a form of community-led collective action.

■ **KEYWORDS:** collaborative research, community-led collective action, environmental justice, feminist methods, generativity, political ecology, racial capitalism, toxic pollution

This article examines how we, as political ecologists committed to environmental justice, navigate the representational dilemmas inherent in our research on toxic exposure. We know that toxic harm inversely tracks broader distributions of wealth and power. This is a foundational principle of environmental justice and of political-ecological work like ours. Yet we also know that our work as researchers can magnify the very harms we hope to document and mitigate.

In her 2009 essay “Suspending Damage,” Eve Tuck takes on what she calls “damage-centered research,” describing it as “research that intends to document peoples’ pain and brokenness to hold those in power accountable for their oppression” (2009: 409). Such research, Tuck argues, is a form of “poison” that further pathologizes and harms the communities whose rights it purports to defend. Poisonous research is not harmful by intent, but rather suffers from what she calls a “flawed theory of change” (2009: 413). Her proposed “antidote” is collaborative research that challenges oppression by advancing a community’s aspirations, capacities, and resources.

This “desire-centered” approach aims not to ignore harm, but instead “to reformulate the ways research is framed and conducted” so that “findings might be used by, for, and with communities” (2009: 409).

Here, inspired by Tuck’s call, we ask what political ecologists have done to address the potentially harmful nature of our toxic(s) research. Our review begins by defining what we call “political ecologies of toxics,” a transdisciplinary body of work that relates to but is distinct from environmental justice advocacy. Much of this work, we show, has insightfully linked toxic harm to broader structures of dispossession, accumulation, and violence, but it varies in how well it addresses other dimensions of the affected communities’ complex realities and concerns. We turn next to recent efforts to reckon with the queerness, generativity, and even protectiveness of toxics. Although not always collaborative in nature, these studies reveal how the fetishization of purity obscures complex forms of toxic entanglement, stigmatizes “polluted” bodies, and can thereby do as much harm as the substances that render us “impure” to begin with. Finally, we examine how political ecologists have increasingly taken up collaborative, decolonial, Indigenous, and feminist methodologies, which decenter the authority of academic researchers and position research as a form of community-led collective action (see Nading 2020).

Our review traces these theoretical and methodological shifts across time, space, and discipline, highlighting the collective actions they have supported as well as the places where their impacts remain limited. We also probe the potential pitfalls of a focus on desire, agency, and generativity, when toxic exposure constitutes such a pervasive, socially uneven form of violence. Our aim throughout is not to assail research that we find harmful, but to better understand how we can address the toxic matter of our research while fostering more-than-human capacities to resist the systematic intoxication of our bodies and environments.

Defining Political Ecologies of Toxics

Toxics are substances that do bodies harm, and thus toxicity is inherently relational. Yet conventional approaches to toxicology, epidemiology, and environmental health tend to conceive of both substances and bodies in isolation. For example, medical and legal measures of toxicity seldom consider how a given toxic interacts with other substances or with differently positioned, conditioned, and disabled bodies (Alaimo 2010). By contrast, political ecologies of toxics are all about how relationships at different scales result in uneven patterns of toxic exposure, harm, and response. In our minds, this field includes any attempt to understand how social structures, cultural differences, and power dynamics shape the production, distribution, conceptualization, and embodiment of industrial toxics generated at any point in the capitalist world system.

If this relational approach is what political ecologies of toxics have in common, then where do they differ? As suggested above, variation abounds not just along theoretical and methodological lines, but also as a function of the intent of the research itself. To visualize this distinction, imagine a three-part Venn diagram (see Figure 1). One circle contains political-ecological research that emerges directly from environmental-justice (EJ) movements and documents toxic harm in marginalized communities, largely but not exclusively in the United States. The next circle contains political-ecological research on similar patterns of toxic harm but prioritizes theoretical questions that may or may not directly serve the needs of EJ movements, in some cases because no such movement exists *in situ*. The third and final circle in our diagram contains political-ecological research on the relationality of toxics—how they permeate social life, convey larger societal prejudices, and co-produce bodies even as they harm them.

Figure 1. This Venn diagram is our way of mapping out the complex scholarly landscape we traverse in this article. The arrows indicate the direction taken across this landscape, each corresponding with moments of substantive discussion in the article.

Keep in mind that this is a Venn diagram: the circles overlap. And we believe that they will further converge as more of us embrace collaborative methods within feminist, decolonial, Indigenous, and/or more-than-human frameworks. Indeed, this convergence is what inspires this article. As scholars committed to environmental justice, we are heartened to see collaborative methodologies advancing political ecologies of toxics in this way. Yet, like the scholars and communities involved, toxics research by, for, and with communities takes many forms. Let's now examine how this shift has come about, what forms it takes in practice, and what it means for the field.

Exploring the Circles

Foundations of Environmental Justice (Circle 1)

What we now know as "environmental justice" emerged in the 1970s and 1980s as part of civil rights struggles led by Black, Indigenous, Latinx, Asian American, and Pacific Islander American communities in the United States. Foundational EJ scholar-activists have long worked with EJ movements to document environmental inequalities, advocate policy reform, and envision more just futures (see, e.g., Bullard 2000; Lee 1992; Mohai et al. 2009; Peña 2011; and Taylor 2014). Subsequent work has further integrated EJ principles with intersectional theory and transnational activism (Bahng 2015; Finney 2014; Johnson 2017; Pellow 2007; Sze 2006). Then and now, the common denominator is the direct connection with EJ activism and policy advocacy. This is research *for* EJ, not research about it.

Including this “core” EJ research in our definition of political ecologies of toxics warrants an explanation. Like most everyone cited in this article, we owe a tremendous intellectual debt to EJ movements and scholars. Without their work, there would be no political ecologies of toxics. At the same time, we want to be clear that academic political ecology is by no means a natural ally or accomplice of EJ. Research in the second and third circles of our diagram does not necessarily advance the interests of EJ movements. But some of it does. In what follows, we engage work that bridges the first and second circles—that is, scholarship that prioritizes theoretical or “academic” questions while also seeking to advance struggles for environmental justice.

Toxics as Violence (Where Circles 1 and 2 Overlap)

Violence is a central theme in political ecologies of toxics. Not only are toxics often weaponized, they also show how different forms of violence co-constitute and amplify one another. Following US-led chemical warfare in Southeast Asia and South America, political ecologists have helped to expose the military-industrial complex that develops toxic weapons and then redeploys them as civilian commodities (Hecht 2011; Johnston 2018; Russell 2001). In war zones, these substances’ long-term effects include not just health and environmental harms, but also displacement, social conflict, and interpersonal violence (Chi 2020; Stewart and Fields 2016; Rubaii 2016).

On and off the battlefield, toxics are also one of the mechanisms through which structural violence operates. Referring to “the systematic ways in which a given social structure or social institution kills people slowly by preventing them from meeting their basic needs” (Peña 2011: 207), structural violence kills not just through deprivation or a lack of goods, but also through an excess of bads, from heavily subsidized corn syrup in the food to heavy metals in the water to black carbon in the air. Even in so-called “peacetime” conditions, toxics serve as insidious instruments of degradation, dispossession, and death (Ahmann 2018; Davies 2019; Morales et al. 2012; Wright 2021). The literature on “sacrifice zones” offers a case in point.

“Sacrifice zone” originally described bounded spaces, such as nuclear waste sites, that are intentionally made uninhabitable in the name of national defense, development, or the like (Endres 2012). In EJ scholarship, the term has since come to encompass any locale or region where polluters and policymakers knowingly burden marginalized populations with environmental harm (Lerner 2012). In 1982, for example, the State of North Carolina built a PCB landfill in Warren County against the will of the area’s predominantly poor, Black residents. As a catalyst for the US EJ movement, this struggle laid bare how calculated uses of the state’s coercive powers result in systematically uneven concentrations of toxic harm (Bullard 2000; Vasudevan 2012).

By now, there is a rich literature theorizing (and complicating) how this kind of localized “sacrifice” operates at a systemic level. Laura Pulido, for example, has taken a cue from Cedric Robinson to argue that “environmental racism is constituent of racial capitalism” (2017: 524). Willie Jamaal Wright takes this a step further, arguing that uneven toxic exposure is a “form of state-sanctioned violence” (2021: 795) inextricably tied to other aspects of racial capitalism in the United States, including institutional discrimination, mass incarceration, and extrajudicial murder. This violence is materialized, in part, through the intentional use of racialized communities as a “sink” for toxics at sites of production and disposal, as seen above. But it is also enacted through the abandonment of racialized communities and through the deliberate neglect or mismanagement of vital infrastructures, as in the Flint water crisis (Pulido 2016).

Along similar lines, political ecologists have also confronted the toxic violence of settler colonialism (Bagelman and Wiebe 2017; Liboiron 2021). This work reveals how toxics operate in service to projects of Indigenous erasure, removal, and what Deborah Davis Jackson (2011) calls

“dysplacement”—a condition where communities are alienated from their environments even when they remain in place. Traci Brynne Voyles (2015), for example, has examined the history and legacies of uranium mining on Diné (Navajo) land in the US Southwest. Her work highlights how the state and private interests have long colluded not just in the dehumanization of Diné persons, but also in the erasure of Diné lives and livelihoods, all in an effort to render their land a desolate “wasteland” available for plunder—that is, “empty except for Indians” (2015: 8; see also Yazzie 2018). Voyles describes this as a process of “wastelanding,” in which toxics serve as a technology of both short-term extractivism and long-term occupation.

Toxics and Collective Action

In addition to showing how toxics act as a form of violence integral to racial capitalism, research in the second circle of our diagram addresses how communities respond to said violence. Building on foundational EJ research, political ecologists have examined how established civil rights movements in the United States evolved to take on toxic exposure in marginalized communities. For example, Melissa Checker’s (2005, 2007) long-term work with residents in Hyde Park, Georgia, documents the experience of a Black community surrounded on all sides by industrial pollution new and old. In the 1990s, when Hyde Park was excluded from environmental restitution provided to nearby white communities, Black residents sought redress by building on their long-standing struggle for access to basic utilities, employment, and education (Checker 2007).

As part of an emergent, translocal EJ movement, the events in Hyde Park coincided with similar ones in communities across the country. In her formative essay “Nature as Community,” Giovanna Di Chiro (1995) reminds us that this organizing was (and is) overwhelmingly led by working-class cis and trans women of color, often but not exclusively in urban contexts. Often clashing with mainstream environmentalism, femme-led resistance to toxics has engendered new movements that transcend the compartmentalization of activism along lines of race, class, gender, disability, age, and species.

Coalitional organizing around reproductive rights is a crucial case in point. In “Living Environmentalisms,” Di Chiro draws on Bernice Johnson Reagon’s concept of “coalition politics” to show how these movements come together in defense of social reproduction, defined as “the maintenance and sustainability of everyday life and earthly survival made all the more difficult by global economic and environmental crises” (2008: 294). Her account reveals how a movement for reproductive freedom led by Asian and Pacific Islander American women in East Oakland, California, grew to include a host of related concerns. Among them was a medical-waste incinerator, long known to be a source of toxic harm in the community and eventually closed as a result of the coalition’s work.

Although toxic harm is disproportionately concentrated in marginalized communities of color, it also threatens the social reproduction of some predominantly white communities in North America. In Endicott, New York, at the site of IBM’s first plant, Peter Little (2014) has traced how white, working-class residents cope simultaneously with economic hardship and lingering toxic pollution in the wake of IBM’s departure. As in Warren County, the former IBM plant was declared a Superfund site due to a documented spill of trichloroethylene in the 1970s. This has mobilized resources for mitigation and given residents a focal point for articulating larger concerns about the precarity of their health and livelihoods amid industrial decay. Yet residents have also struggled to garner scientific and legal validation of their claims, suggesting that racial privilege is no guarantor of restitution.

Anna Willow (2014) has similarly found parallels in recent experiences of Anishinaabe communities in Northwestern Ontario and predominantly Euro-American communities living

amid the fracking boom in Ohio. Despite their markedly different historical and cultural contexts, people in both places have organized against toxic pollution as a threat to their everyday social reproduction. Willow attributes this unexpected parallelism to “common perceptions of disempowerment and vulnerability . . . , as growing numbers of people from increasingly diverse walks of life are now being forced to face immediate—and often very serious—environmental challenges that they did not authorize and do not benefit from” (2014: 240).

Lest we overstate such parallels, Jennifer Rice and Brian Burke (2018) remind us of the contradictions within predominantly white communities surrounded by fracking in Southern Appalachia. Theirs is a study of how a “localized,” “inward-looking,” and “culturally specific” movement was likewise driven by working-class women and rooted in the defense of the places in which they and their loved ones “live, work, and play” (cf. Di Chiro 1995). Here, as in Ohio, anti-toxics organizing expresses broader concerns about disempowerment, dispossession, and degradation. In neither case, however, is there an equivalent to the translocal, intergenerational infrastructure that EJ organizing typically builds on in communities of color. These groups take actions compatible with their conservative values as they apprehend the interdependent nature of their own civil rights, livelihoods, environments, and property values (Willow 2014). But their approach does not confront environmental racism, much less their own role therein (see also Bosworth 2021). This leaves them isolated and unprepared (or unwilling) to contend with the translocal, structural sources of the toxic harms they face (see also Zhang 2014).

Toxics and Collective Inaction

Toxic threats to social reproduction can have a galvanizing effect on communities, but collective action in such cases is by no means guaranteed. Political ecologies of toxics have also demonstrated the many barriers to anti-toxics organizing at community and institutional levels. Checker (2005), for example, has shown how the epistemic protocols of environmental regulatory institutions result in a systematic dismissal of local experiences and knowledge. Resulting frustration is only magnified when scientific and regulatory findings themselves conflict. “For every study that has shown evidence of significant contamination,” Checker writes, “there seems to be another that contradicts or mitigates it, leaving residents (and researchers) confused” (2005: 6–7).

But knowledge, or the lack thereof, is only one reason why community organizing can falter in the face of toxic harm. In their influential book *Flammable*, Javier Auyero and Débora Alejandra Swistun (2009) examine the case of a slum community on the outskirts of Buenos Aires, where petrochemical manufacturing and a range of upstream industries have exposed residents to carcinogens like chromium, benzene, and especially lead. Here, the concept of “toxic uncertainty” helps make sense of why residents, despite their ample firsthand experience with environmental suffering, have little collective will to challenge the industries that are harming them (2009: 50–54; see also Dietrich 2013). Despite their suffering, many residents depend on the industries in question for work, housing, healthcare, and other needs. Companies solidify this sense of dependence through local social responsibility campaigns, sponsor their own research to generate doubt about the effects of toxics, deploy physicians to make conflicting diagnoses, and pressure government to delay corrective action into oblivion (Auyero and Swistun 2009). Residents, meanwhile, are socially stratified, physically exhausted, and far from homogenous in their own experiences of structural violence, which include but are by no means limited to toxic exposure. All of this limits the extent to which a common threat can bring people together.

Similarly, in her long-term research with so-called “cancer villages” in rural China, Anna Lora-Wainwright (2017) unravels the sense of resignation that pervades community struggles

with toxic exposure. Like their counterparts in urban Argentina, poor Chinese villagers facing severe toxic exposure frequently profess uncertainty and ignorance about the effects of polluting industries on their bodies and environments. Lora-Wainwright, however, also recounts how the same villagers who profess uncertainty in front of government officials will, in other contexts, make confident, even exaggerated claims about those effects. This dynamic, she observes, “is rooted in uneven power relations” (2017: 8; see also Zhang 2014). We are reminded here that an expression of “toxic uncertainty” may be a politically necessary performance as much as it is a genuine expression of confusion or ignorance.¹

Speaking of confusion, the epistemic and ontological conceits of environmental toxicology often work against EJ organizing. In her work with Mohawk communities in Akwesasne, New York, Elizabeth Hoover (2017) finds that the methods and pace of toxicological analysis initially alienated residents from the research required to document their exposure. Residents measure their own exposure to harm not in the discrete dosages of PCBs they may get from eating local fish or produce, but in the cumulative social, bodily, and cosmological effects of long-term processes of colonization, industrialization, and terraforming in the region. Beyond the normative, abled, or “average” individual bodies interpellated by risk assessment, environmental health, and biomedicine, it is the “social body” of the community, human and otherwise, that manifests and potentially resists toxic harm in Akwesasne (Hoover 2017; see also Pine and Liboiron 2015). As we will discuss in more detail below, it was not until residents themselves became active participants in the anti-toxics research that it began to resonate meaningfully with their concerns and become a site of collective action.

In addition, the temporalities of toxics themselves affect collective (in)action (Gray-Cosgrove et al. 2015). Whether the result of a sudden release or a gradual accumulation, most toxics take their full effects over the course of many years, often in ways that lend themselves to obfuscation by culpable parties, as in the cases discussed above. Toxic harm is often so gradual as to render it invisible to everyone but those directly experiencing it—and sometimes even to them (but see Davies 2019). This “slow violence,” as Robert Nixon (2011) calls it, further interacts with a range of other sources of harm, such as chronic illness, food insecurity, and state violence. Such tempo and interactivity add to the uncertainty that can make it remarkably difficult to sustain collective action around toxic threats to social reproduction.

Toxic Entanglements (in between Circles 2 and 3)

As work in the first and second circles of our diagram makes abundantly clear, toxic harm is a form of violence—it is often “slow,” invisible, and inextricably bound up with other sources of harm, but it is a form of violence all the same. And this makes toxic harm a common point of social struggle, however fraught with uncertainty, as individuals and communities confront threats to their social reproduction. Even so, toxics are incredibly complex in their material, social, and cultural entanglements and as such have inspired political ecologists to think beyond themes of violence, uncertainty, and collective (in)action. The third circle of our diagram is defined by this complexity and by efforts to understand how toxic substances, despite the violence they enact, affect (more-than-)human lives in generative and often unexpected ways.

Toxics harm us, but they also help make us. As part of a larger, cross-disciplinary conversation about what is often called “entanglement,” political ecologies of toxics have revealed the ways in which toxic substances bring us into relation with ourselves, our surroundings, and with other(-than-human) beings (Carrier and West 2009). A key concept in critical studies of science, medicine, and environment, entanglement describes the material and semiotic interactions through which “people, pathogens, vectors, and their shared surroundings are always

in the process of becoming, together” (Nading 2014: 202). Just as, per Nading (2014), mosquito guts are “entangled” with the dengue virus, with individual human bodies, and with public health institutions, toxics help (un)make relationships among molecules, systems, and the scales in between.

Take, for example, the case of lead. Lead has a long and consequential history as a maker and breaker of human endeavors (Warren 2001). We often associate lead poisoning with the kind of structural violence that is enacted through chipping paint in neglected buildings or the corrosion of old pipes in their walls. But lead also serves as a vector of affective attachment, despite its toxicity. In their Mexican Exposures project, Mary Leighton and Elizabeth Roberts (2018) work with working-class communities, particularly mothers, in Mexico City to understand the aesthetic and social significance of leaded ceramic pots or *ollas*. These elaborately decorated *ollas* are passed down across generations and help mediate ties to ancestral communities in the countryside. Lead is believed to add shine and sweetness to the glaze, and so despite more than 25 years of lead-awareness efforts, some families still consider their *ollas* “essential, especially on religious holidays.” Interestingly, Leighton and Roberts explain, some research participants do not see the pots themselves as the source of harm from lead. Instead, they blame a deterioration of pot fabrication and an overall increase in environmental exposure to toxics, including but not limited to lead. This enduring attachment suggests the affective power of toxics as elements in the making of kinship, ancestry, and place.

If toxics are woven into the fabric of our sociality—at times literally (Rovira and Domingo 2019)—they are also woven into our biopolitics. In her writing on conjugated estrogens, Donna Haraway (2016) unravels the entangled history of agriculture, medicine, and reproductive rights. Like millions of women who have reached menopause since the late twentieth century, Haraway was once prescribed hormone replacement therapy derived from estrogen in the urine of mares that are serially impregnated in agri-industrial facilities. She has lived through an ongoing transformation of gender and sexuality enabled, in part, by the use of hormones like estrogen in gynecology, gender correction, and other areas of medicine. And, more recently, she has treated her elderly dog’s incontinence with diethylstilbestrol (DES), a synthetic estrogen infamous for causing cancer and other health problems in the daughters of women who were prescribed it during pregnancy in the early-to-mid twentieth century. The fact that some of these conjugated estrogens are “expensive, carcinogenic, immune-suppressing, anemia-inducing, smooth muscle-plumping molecules” (2016:108) underscores how deeply enmeshed toxic substances are in the biopolitical constitution of bodies within and across species—what Michelle Murphy (2008) has called a “chemical regime of living.”

Our discussion of lead and estrogens points to the ways in which the aesthetic and medicinal properties of toxics bring them into the most intimate, embodied aspects of our lives.² But even when toxics are perceived in less direct ways, they can have a profound effect on human subjectivity. Nicholas Shapiro’s (2015) ethnographic investigation of domestic formaldehyde exposure in the United States pieces together the sensorial, interpersonal, and biomedical cues that attune people to the presence of toxic chemicals in their homes. “It is,” Shapiro writes, “through the articulation of these small corrosive happenings that residents reckon with how their homes are decomposing into them as they decompose in their homes” (2015: 370). In this sense, toxics are both *materially* part of the “chemosphere” through which we come into being as part of our environments and *affectively* part of how we attune to and know ourselves, our others, and our surroundings (Carrier and West 2009). To the extent that this can lead to an “embodied apprehension of human vulnerability to and entanglements with ordinary toxicity” (Shapiro 2015: 369), toxic exposure engenders complex forms of affect that remind us not to address these experiences only for what they lack (e.g., awareness, agency, health, livelihood, life).

Toxics permeate late-capitalist biopolitics in ways that mix the infliction of harm with the promise of pleasure, belonging, utility, and relief. So far, though, we have only considered the complex effects of toxics on individual bodies and their interrelations. What about social bodies? Can something that harms individuals have different, even protective effects on the collective? In her writing on fossil fuels, Kathryn Yusoff has shown that they “constitute the very possibilities for certain types of social, sexual, political, and labor arrangements” (2015: 204). Toxics do similar work. They, too, are “a motor of socialities that configure and carry the Anthropocene body politic into being” (2015: 206; see also Blanchette 2015).

Here Elizabeth Roberts’s work is again instructive. As part of her collaborative “bioethnography” in Mexico City, Roberts (2017) found that residents of Colonia Periférico are “protected” by their material and symbolic association with open sewers and other sources of toxic pollution. For poor people who often find themselves caught in violent struggles between the state and narcotraffickers and who are frequently targeted for paternalistic public-health interventions, being associated with shit affords a measure of protective isolation insofar as it can keep certain harmful or undesirable things out of the community. Not only does this complicate theories of entanglement (by framing disentanglement as a form of power), it points to the different valences that toxic substances acquire as they “conjugate” with bodies, institutions, and places in the world. Living in shit takes a toll on individual bodies, and it certainly reinforces larger processes of marginalization. But the flipside of such entanglement is, it turns out, a potential resource in the defense of social reproduction (see King 2016).

Nor are humans the only creatures for whom toxic waste takes on multiple valences across bodies and scales (Kirksey 2020). We have already seen how Haraway’s relationship with her dog was enabled, in part, by a toxic substance doubling as a medicine. But what about wild animals? On one hand, Joe Masco (2013) reminds us of the harms done to fish, which are forced to “trip” on the pharmaceuticals that we flush into our waterways in ever-increasing quantities (see also Collard 2018; Todd 2018). “We need,” Masco declares, “a crimes-against-species act to protect the fish and other creatures from the roofies we keep slipping them.”

On the other hand, Kim De Wolff’s (2017) work on marine pollution suggests how we can unintentionally do harm to organisms when they become intimately entangled with plastics. The ecologists whom De Wolff has followed care deeply for marine life and want to protect it from the harm of plastic waste. However, they operate on the assumption that it is always best to separate life forms from the plastics in their environments. This can lead to collateral harm for the jellyfishes whose bodies have grown around plastic, for the fishes who have taken shelter in plastic crates, and for the coastal species who travel out to sea on floating “ghost” nets. De Wolff is not suggesting that marine plastics are beneficial to wildlife. Rather, she is arguing that we must confront the sources of new waste even more urgently than we must work to extract prior waste from marine ecosystems. Like humans, marine life forms are harmed by the excesses of the petrochemical industry; and, as with humans, addressing this harm in a robust way means confronting its systemic sources rather than just its isolated symptoms.

Purism and Its Discontents (Circle 3, Continued)

By highlighting the entanglements of toxic waste and organisms in the sea, De Wolff points us toward another matter of growing concern among political ecologists: the politics of purity (Boudia et al. 2018; Liboiron et al. 2018; Shotwell 2016). Above, we saw how marginalized communities are systematically disadvantaged by the toxicological and legal protocols that monitor and regulate toxic exposure. But that is actually only part of the story. Systemic biases in the distribution and regulation of toxics also depend on corresponding biases in the conceptualization

and signification of toxicity. This means, for example, that NIMBYism is not just an economic and social phenomenon, but also a linguistic and cultural one (Park and Pellow 2011). Political ecologists have thus begun to ask who has the power to define “purity” in a toxic world and with what consequences for others.

Put simply, the fetishization of purity both reflects and reinforces larger structures of inequality. In part, this takes the obvious form of stigmatizing already marginalized bodies for their association with pollution—as, for example, when decontamination workers in Fukushima, Japan, have faced discrimination for their possible exposure to radiation (Kimura 2016). But the promise of bodily purity through discriminating consumption and “detoxification” also fuels a multi-billion-dollar global “wellness” industry. Protection from toxics has thus become a commodity fetish like any other insofar as it subsumes social consciousness within the alienated, often self-defeating consumption of goods. Vanessa Agard-Jones (2014) has examined the resulting disconnect between the toxic commodities that we voluntarily apply to our bodies and the ones we fear being exposed to against our will. Some of her Martinican collaborators, for example, liberally apply neurotoxic DEET spray to repel mosquitoes even as they fret over long-term, large-scale use of pesticides on the island’s banana plantations.

Here, we can clearly see the risk of disconnecting consumer choices from the larger “chemical regimes of living” in which they are made (Murphy 2008): this is what allows a quixotic pursuit of purity to occlude the kind of systemic changes that would benefit everyone along chemical commodity chains, including those who produce “nontoxic” products in toxic conditions (Rogers 2013). “Purism,” Alexis Shotwell writes, is “a de-collectivizing, de-mobilizing, paradoxical politics of despair”—“a [harmful] approach because it shuts down precisely the field of possibility that might allow us to take better collective action against the destruction of the world in all its strange, delightful, impure frolic” (2016: 8–9).

In other words, purism can be as harmful as the substances that render us “impure” to begin with. To better understand what this means, let’s return to the matter of hormones or, rather, endocrine disruptors. Our world is increasingly awash in them, as a result of both conjugated hormones in pharmaceutical products like birth control and the hormone-mimicking properties of chemicals like BPA in plastics. Our growing exposure to endocrine disruptors has raised valid concerns about cancer, infertility, and ecological harm (Langston 2010). But it has also fed into what Di Chiro (2010) calls a “sex panic” about the threat that these substances allegedly pose to normative, sexually dimorphous “male” and “female” bodies. Recent work at the intersection of feminist science and technology studies (STS), queer studies, and biology has suggested “how hormones and their environmental disruption can be understood as part of an ongoing process of sexing” (Ah-King and Hayward 2013: 1). Such nuance, however, remains largely absent from public debates around the supposed feminizing effects of endocrine-disrupting pollution. Just as anxieties around landscape-scale environmental degradation can merge with neofascist sentiments (Theriault 2020), fears around the embodied consequences of toxics can coalesce with toxic masculinity, misogyny, and transphobia.

And now, finally, we can address the fact that toxics have figured prominently in recent queer theory and disability studies. But of course they have. By shaping our minds and bodies, often in ways that leave us disabled and/or pathologized, toxics force a reckoning with and rethinking of normativity (see also Agard-Jones 2013; and Ah-King and Hayward 2013). We variously use toxic substances to attract (or repel) others, and we at times invite toxics to act on our bodies as part of healing or enabling assemblages of medicine and technology. In their work on “toxic animacies,” Mel Chen (2011) brings together queer and disability perspectives, in part, by exploring their own firsthand experience with heavy-metal poisoning and multiple-chemical sensitivity. Chen has experienced toxic harm both as a cause of permanent

disability and as a queering of their bodily relationship with the world, including with the furniture in their apartment, with the fellow organisms they encounter outside, and with their lover. Here, we have—against the deeply classist, racist, sexist, queerphobic, and transphobic effects of purism—an apprehension of how toxicity can engender “queer loves, especially once we release it from exclusively human hosts, disproportionately inviting disability, industrial labor, biological targets—inviting loss and its ‘losers,’ and trespassing containers of animacy” (2011: 281; see also Davis 2015).

Politics for a Toxic World (Circle 3’s Radical Edge)

If political ecologists have dispensed with purity as a goal or even a possibility, where do we go from here? What philosophical, ethical, and political orientations might make for a more efficacious and equitable approach to dwelling on a planet that will forever bear our toxic legacies? At circle 3’s interstices, we find a growing body of work on what Max Liboiron and colleagues (2018) call “slow activism,” a broad mode of response that combines a feminist understanding of everyday, embodied politics of care with a critical STS perspective on how technocratic protocols defuse resistance to toxic harm. Slow activism includes “forms of action that blur the difference between activism and everyday practices” (2018: 342), such as when Colombian farmers work to heal their land from the injuries of chemical warfare even as they struggle to achieve restitution in the courts (Lyons 2018). But slow activism also includes more expressly ‘political’ efforts by communities to assemble evidence of toxic harm and to recruit accomplices in the pursuit of justice (Ahmann 2018).

Registering this plurality of responses to the fast and slow violence of toxics points researchers toward a range of new questions, including the one we began with so many pages ago: how and with what consequences have political ecologists addressed the potentially damaging effects of our toxic(s) research?

As we have built upon studies linking toxic harm to multiple forms of violence, we have likewise moved toward a more comprehensive understanding of what toxics mean and do across differing bodies, communities, places, and times. While complex in its origins, this shift has resulted in no small part from concerns around the potential toxicity of research itself. Recall what Tuck (2009) said about “damage-centered research” acting as a form of poison in marginalized communities. This insight has helped many researchers avoid approaching toxicity simply as a capacity of certain substances or a condition of certain communities, thus reducing them, respectively, to the sources and repositories of harm (Nading 2020). Instead, toxicity is increasingly deployed as a method—or, per Liboiron and colleagues, “a way to focus on how forms of life and their constituent relations, from the scale of cells to cultures, are enabled, constrained, and extinguished within broader power systems” (2018: 336). Concepts like (dis)entanglement, generativity, and slow activism all offer compelling ways to challenge the toxicity-as-damage paradigm and engage instead with toxicity-as-method.

Still, the other key aspect of Tuck’s challenge remains largely unaddressed by work in circle 3. Recall how, in place of damage-centered research, Tuck urges a focus on collaborative research that centers desire—that is, the complex needs, aspirations, capacities, memories, and futures of individuals and communities as they contend with toxics and other systemic sources of harm. We find glimpses of this in some of the work we have reviewed—such as in Auyero and Swistun’s (2009) use of participatory photography with youth in Flammable or in Roberts’s (2017) reinterpretation of sugary soft drinks as a currency of kinship in Mexico City. But to find research that truly embraces what Tuck might consider a “desire-centered” framework, we need to look into the space where our three circles overlap. Vibrant and growing, this space is

distinguished by the use of collaborative methodologies in the design, execution, and dissemination of political-ecological research on toxics.

Bringing the Circles Together: Desire-Centered, Collaborative Research

Tuck's vision of desire-centered, collaborative research revolves around what she calls "complex personhood" (2009: 420, following Avery Gordon). This is the principle that humans are complicated: our desires, broadly defined, are inevitably fraught with contradictions, complicities, uncertainties, and even cynicism. This complexity, in turn, offers insight into the very entanglements and valences we discussed above. The aim is not to substitute desire for damage as the fetishized object of inquiry. The aim is to take direction from the people enduring toxic harm—in all their complexity—so that their interests take precedence over those of professional researchers, especially those who do not belong to the communities in question. This means respecting not just the individual right to refuse participation in research, but also the collective right to refuse—at all phases of the research process up to and including dissemination (Rubis and Theriault 2020). Rather than an aim in itself, desire-centered collaborative research is a way to generate knowledge that marginalized communities can use in defense of their social reproduction. Outsider researchers can play a pivotal role in generating this knowledge and putting it to use. But their role, as we will discuss in more detail below, does not involve taking center stage, controlling the script, or unilaterally raising the curtain (Vasudevan 2012). This, for us, is the virtue of this framework: it repositions toxics research as a form of *community-led collective action*.

As a principle for research, then, desire goes hand-in-hand with collaborative methodology. This, too, is a broad tent, and we only engage a fraction of it here. On one hand, we take "collaboration" to mean cooperative research among scholars within and across disciplines as well as between scholars and practitioners—what Elizabeth Hoover and colleagues describe as an "emergent, boundary-crossing effort to integrate social science with environmental health practice" (2015: 1100). Our admiration for such action-oriented, transdisciplinary collaboration is, in part, why we have repeatedly singled out Leighton and Roberts's (2018) work in Mexico City. But it also applies to Liboiron's (2021) Civic Laboratory for Environmental Action—"a feminist, anti-colonial, marine science laboratory that studies plastic pollution"—and to a number of other projects we have not had space to introduce (e.g., Madrigal et al. 2016; Wylie and Albright 2014).

On the other hand, however, our main concern here is researcher collaboration with communities that are marginalized and facing toxic pollution amid other forms of structural violence. When we refer to collaborative research, we invoke a range of feminist, decolonial, and non-hierarchical or egalitarian methodologies, which Hoover and colleagues (2015) refer to as "community-based participatory research" or CBPR, per environmental health lingo. A key principle of such research is that people have critical insight into their own conditions, experiences, and aspirations, no matter their "formal" credentials and skills (Kang 2018). This means centering those insights, no matter their alignment with authoritative knowledge, but it does not mean a summary dismissal of scientific methods or expertise.

Even when they have valid reasons to distrust professional researchers, communities that face toxic harm often seek out such skills. Collaborative research, then, puts those skills to work on behalf of community interests, whether in helping raise local awareness of toxic harm (Vasudevan 2012), holistically documenting experiences of exposure (Hoover et al. 2015), or "studying up" to reveal who benefits from it (Kirsch 2014).

Desire-centered, collaborative research is, we contend, a *scientifically, ethically, and politically robust way to advance collective knowledge and action*.³ The value of such knowledge derives not from its claims to universal truth or dissemination, but in the capacities it can foster for collective action in the pursuit of environmental justice for marginalized communities. What those capacities are and what kind of justice they pursue are context-specific questions that require critical attention to the contours of the communities in question. We will return to this question in our conclusion. First, though, we offer a brief overview of political-ecological research on toxics that is (or strives to be) collaborative and centered on desire rather than damage. This is the work that pulls our three circles closer together.

Collaborative Research as Collective Action

Let's start by returning to Hoover's (2017) research with Mohawk communities in Akwasasne, where New York State meets the Canadian provinces of Quebec and Ontario. Life for Mohawks has changed drastically over recent centuries as a result of settler colonialism and capitalism. After the completion of the Saint Lawrence Seaway in 1959, upstream industries leached untold quantities of PCBs into the soil and ultimately into the river. This has profoundly altered Akwesasne's relations with their traditional food sources, including but not limited to fishing and farming. As a result, Akwasasne has been the site of environmental health research and intervention since the late 1970s, and the PCB plume has been an EPA Superfund site since 1984. Despite resident concerns with this pollution, early research into the matter alienated many of them by treating them as potentially unreliable sources of data rather than research partners. Akwesasne then established their own taskforce and advisory committee to develop the "Good Mind Research Protocol" based on "three main guiding principles: skennen (peace), kariwio/kanikonri:io (good word/good mind), and kasatstenhse:ra (strength)" (2017: 137).

In 1986, residents began working with academic researchers at SUNY Albany who were willing to respect the protocol and include community experts, such as Mohawk midwife Katsi Cook, in all phases of the research process. While the resulting research has by no means been free of power differences and other challenges (Hoover 2017), it has ensured that researchers take direction from and help build capacity among community partners. Residents have secured some favorable outcomes beyond the Superfund mitigation, including funds for Indigenous-led education. Such measures will never fully address the social, psychological, and cosmological dislocations that residents have experienced. But collaborative environmental health research in Akwasasne has, Hoover shows, bolstered local efforts to revitalize Indigenous forms of kinship, spirituality, and ecology. "Mohawks," she writes, "resisted the binary of researcher/subject, citizen/scientist, creating a third space of sovereignty in which they refused the subjugated role to which communities under study are commonly relegated" (2017: 262).

If the Akwasasne case shows how collaboration works in both of the senses introduced above (i.e., transdisciplinary environmental health research and as community-based participatory research), we find a distinct but complementary example in the Newtown Florist Club (NFC) and its collaboration with university-based researchers (Yen-Kohl and NFCWC 2016). The NFC was founded in Gainesville, Georgia, in 1950, when a predominantly Black group of women established a mutual-aid fund for funeral expenses and then, in dialog with the civil rights movement, came to act as defenders of environmental justice. Like the city of Hyde Park some 140 miles southeast (Checker 2007), Gainesville is a textbook study in environmental racism. For generations, segregated Black communities there have been forced to live in unsafe proximity to a range of sources of toxic pollution. Resulting public health problems, including higher rates of rare cancers, lupus, and other exposure-related illnesses, have attracted a

steady stream of researchers, whose studies are often inconclusive and in no way beneficial to residents. In 2009, in an effort to tell their own stories and articulate their own visions of a better future, NFC members formed a writing collective together with students, professors, and a range of others at the University of Georgia—“lawyers, economic development specialists, environmental engineers, toxicologists” (Yen-Kohl and NFCWC 2016: 53). Toxic exposure and related health concerns are important to the Collective’s work, but always as part of a broader pursuit of self-determination and civil rights. The Collective write that this is “designed to combine the lived experiences of Newtown residents with academic researchers to create a forum where the voices and experiences of one cannot be distinguished from those of the others” (2016: 61).

Beyond these two salutary examples, political ecologists have employed collaborative methods in their research with environmental justice coalitions in Managua (Fisher and Nading 2020), DC/Baltimore (Ahmann 2018; Reese 2019), Southeast Louisiana (Kang 2018), Albuquerque (Yazzie 2018), Kolkata (Banerjee 2015), and many other places. In every case, toxics are a pervasive dimension of society and environment, but in no case are they addressed in isolation from larger infrastructures of social and environmental struggle. This does not mean that these collaborations are exempt from internal power imbalances and unintended consequences. To the contrary, it means that we should not conflate collaborative political ecologies with projects that, say, offload research labor onto individual mothers while simultaneously dismissing their knowledge as hysteria, as has been the case in Japan since the 2011 triple disaster at Fukushima (Kimura 2016). Collaborative research may drive the convergence of the three circles, but it can also be coopted and atomized in the absence of assertive community-level organizing infrastructures.

Conclusion

We believe that political-ecological research on toxics is more rigorous, ethical, and impactful when it is designed, implemented, and disseminated in collaboration with communities. We feel especially confident about this when the community in question consists of structurally marginalized persons exposed against their will to toxics. But it also applies when the “community” consists of professional toxicologists (Fortun and Fortun 2005; Tousignant 2018), activists in transnational advocacy networks (Fortun 2009), mothers with Geiger counters (Kimura 2016), or scattered groups of urban denizens concerned about air quality (Calvillo 2018). This much, we hope, is clear in what we have said so far.

Let’s conclude by pausing to consider what (or who) precisely our discussion of community collaboration interpellates. Above, we defined communities as containing a range of both professional and lay “experts” and as having varying degrees of organizing infrastructure to build on. Generally, though, we have implied that the communities with whom scholars collaborate (or fail to do so) exist in some kind of a stable, bounded way. This may be true in some instances, particularly on an intuitive or superficial level. But toxics are nothing if not boundary-crossing, mercurial, and disruptive. In many cases, it is extremely difficult if not impossible to draw stable boundaries around the places, bodies, and social formations affected by a given toxic’s promiscuous circulations. This warrants, we feel, a concluding reflection on the capacities and limits of collaborative research.

In her influential book *Advocacy after Bhopal*, Kim Fortun (2009) develops the concept of “enunciatory community” to describe the social formations she saw activated in the wake of the

catastrophic 1984 gas leak at a negligent Union Carbide pesticide plant in Bhopal, India. Enunciatory communities, she writes, are not more or less stable groupings of residents, professionals, activists, citizen scientists, or some combination thereof. Rather, they are “chameleonlike,” coming together and shifting amid dilemmas, contradictions, and uncertainties as an “emergent effect of crosscutting forces” (2009: 13–14). In the Bhopal case, an enunciatory community formed through the shape-shifting advocacy networks that connected survivors with scientists, activists, volunteers, scholars, and others across India and the world. Most of the cases discussed above involve enunciatory communities that are less complex and extensive than those activated by Bhopal. But all of them involve translocal networks of actors and institutions extending well beyond the site(s) where a known or suspected process of toxic harm is unfolding. This is due, in part, to the aforementioned insidiousness and mobility of toxic substances themselves: toxic “plumes” in the air, ground, water, housing, and other infrastructures constantly exceed the bounds of any geographically or demographically defined community. But the translocal nature of these networks is also due to the social and ecological work that toxics do as a function of their material and semiotic promiscuity.

Toxics exceed the spatial, temporal, social, and species boundaries that typically orient researchers to collaboration with communities (Davis 2015; Kirksey 2020; Yusoff 2015). This, in turn, makes any collaborative research endeavor more complex and fraught than it seems at first blush. Whether or not we care to notice, political ecologists involved in collaborative research on toxics are part of enunciatory communities that complicate what it means to collaborate in a politically effective, ethically sound, and intellectually generative way. Who belongs to “the community,” who has a voice in the research process, whose desires are recognized and pursued—these are just a few of the difficult questions raised by collaborative work with the enunciatory communities that toxics activate. We urge political ecologists to embrace this work with inclusive methods, promiscuous contacts, rigorous ethics, and active imaginations.

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NOTES

1. Pavithra Vasudevan's (2012) work brings out the broader significance of performance in environmental justice activism.
2. Due to space constraints, we do not here discuss addictive toxics like cocaine and methamphetamine; however, one could make a similar argument about them (Epele 2011).
3. We agree, though, with Pulido (2016) and Wright (2021) that EJ research cannot afford to prioritize legibility in the eyes of policymakers, so many of whom remain willful perpetrators of toxic violence. For us, political efficacy is primarily a function of concessions won through civil rights struggle.

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