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Toxic Bodies: Water and Women in Yucatan

Angel G. Polanco Rodríguez and Kata Beilin

> *Imagining human corporeality [and I would argue, all corporeality] as trans-corporeality, in which the human is always intermeshed with the more-than-human world, underlines the extent to which the substance of the human is ultimately inseparable from "the environment." It makes it difficult to pose nature as mere background, as Val Plumwood would put it, for the exploits of the human since "nature" is always as close as one's own skin—perhaps even closer. Indeed, thinking across bodies may catalyze the recognition that the environment, which is too often imagined as inert, empty space or as a resource for human use, is, in fact, a world of fleshy beings with their own needs, claims, and actions. By emphasizing the movement across bodies, trans-corporeality reveals the interchanges and interconnections between various bodily natures. But by underscoring that trans indicates movement across different sites, trans-corporeality also opens up a mobile space that acknowledges the often unpredictable and unwanted actions of human bodies, nonhuman creatures, ecological systems, chemical agents, and other actors.*
>
> –Stacy Alaimo, *Bodily Natures*

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On March 3, 2018, with percussion music filling out the downtown of Merida, three hundred people marched through the streets to protest the project to construct a large porcine factory farm in Homún (Santana). Homún and nearby Cuzamá form part of the Geohydrologic Reserve *Anillo de Cenotes* (literally a "Ring of Cenotes"), an area known for its great beauty. Cenotes are sacred for Mayas, and important for local tourism, increasingly marketed as ecotourism.[1] Protesting citizens claim that the factory farm will further pollute the already contaminated waters of the cenotes, which will be damaging to Mayan cultural identity and to their ecotourism-based economy. Cenote tourism is one of many cases in which globalized markets incite the indigenous communities to turn the sacred elements of their culture into an economic asset; however, these same markets soon destroy these new economies and decimate the sacred resources. The tension between sacred ecologies and the market is measured by the dangerous levels of toxic substances in the water, soil, and human bodies (Figure 1).

Figure 1. Cenote, a sinkhole characteristic for Yucatan. Photo courtesy of Kata Beilin.

Chemicals have become ethnographic objects (Kirksey). In 2017, the *Journal of Cultural Anthropology* published a special issue on "Chemo-Ethnographies." In the introduction, Nicolas Shapiro and Eben Kriksey write: "Chemicals are becoming increasingly useful linking figures as ethnographers follow complex, multisited, and multiscalar phenomena." These "are informing nascent approaches to writing culture in the Anthropocene" (481), because, we would add, Anthropocene culture is a culture of toxicity. There are hardly any human contexts in which meanings do not need to be refigured through the overwhelming context of quasi-ubiquitous toxicity, a slow and invisible catastrophe affecting the whole planet, yet unequally distributed.

Chemo-ethnographies constitute proof that the "slow violence" (Nixon) of toxic profits have eventually become visible, and that more and more of us are taking steps to make others aware of the toxic relations between economy and health, disentangling them and taking action by transforming our ways of life.

In yet another special issue of the *Journal of Social Studies of Science*, called "Toxic Politics: Acting in a Permanently Polluted World," the editors highlight the complexity of the entanglements between life and toxicity in the Anthropocene cultures. They point out that "toxicity both disrupts existing orders and ways of life at some scales, while simultaneously enabling and maintaining ways of life at other scales" (Liboiron et al.). As a result of toxicity, life mutates, both in its semiotic and material dimensions, adapting to survive illness and resist death in toxic conditions. There is a conviction that the economy would not work without the poisonous substances, that there is a "social optimal level of pollution," because, as the discourse goes, "otherwise there would be no incentive to pollute" (CC BY-NC-SA). The culture in which the belief that *health has to be damaged so that life can go on* constitutes a new normal. In his essay in this volume, Eduardo Molinari describes this state of affairs as a "transgenic culture."

Angel Polanco's (2015a and b, 2017, 2018) research shows that in Yucatan's ground water, the levels of pollutants in the areas adjacent to the factory farms and agricultural zones are dangerously exceeding international norms. Additionally, these heightened levels of pollutants coincide with extremely high levels of toxic substances, various of them likely carcinogens, in the blood and breast milk of Mayan women living in these regions. The state of Yucatan has the second highest level in Mexico of cervical cancer in women. The women inflicted with high mortality rates of this and other kinds of cancers are mostly, although not exclusively, Mayan women.

This essay builds on Polanco's research on water pollution and concomitant human health hazards in Yucatan, and on Suryanarayanan and Beilin's ethnographic research on Mayan cultures of nature to show how chemical toxicity transforms local landscapes and life experiences and practices, and as a result affects the lived cultures. The authors of this essay have been trained within different epistemic cultures and fields. Polanco measures chemical exposures in bodies, quantifying levels of pollutants by counting milligrams of the substances per liter of water, blood, or breastmilk. He compares his results with international norms and draws conclusions about the health hazards of these substances and the need for better implementation of the treaties forbidding the usage of most toxic pesticides. His team members interview the people whose blood they test, and they have established that respondents are often unaware of the invisible dangers of the pesticides. Beilin and Suryanarayan conducted ethnographic research in 2016 and 2017 in various areas

of Campeche, Yucatan, and Quintana Roo, and witnessed both the damage inflicted by toxic substances, as well as the struggle to resist. By combining epistemological practices in this essay, the authors will show that chemical toxicity, a great challenge for environmental health, needs to also be understood, analyzed, and reflected upon as a component of today's cultures and a factor of their transformation.

We understand culture as set of everyday practices and meanings, structured around an array of human and nonhuman bodies and matter that possess important semiotic qualities, such as water for the Mayan communities. Both the material and semiotic/symbolic properties of water have changed as a result of power exercised by corporations, more often than not, supported by the local government institutions. The toxicity of water has affected human health, leading, as Polanco's (2017a and 2017b) research shows, to cancers and death. Suryanarayanan and Beilin's work demonstrates that it has also led to awareness and activism, exercised by hybrid alliances between scientists, international foundations, activists, and Mayan leaders that denounce the use of agrotoxins and promote agroecology. At the same time, various Mayan leaders and their apprentices work to recover their ancient ways of life in partnership with forests, cenotes, maize, and their sacred Melipona bees. They take the role of guardians of their land.

We attempt to avoid a simplistic geography of conditioning, victimhood, and blame by resorting to Levi Bryant's philosophy that remaps reality by classifying everything that exists (including humans) as objects with varying characteristics and changing degrees of power, which he calls a "gravitational force" exerted by some objects over others. In Bryant's philosophy, the most powerful are "bright objects" that control the traffic of other objects around them, such as petroleum in today's globalized world. In our story, there are two competing bright objects. The first is water, which has allowed for crops' growth and guaranteed the sustainability of Mayan economies and their ecosystems for centuries. Now it is money, which has generated the for-profit toxicity characteristic of industrial agriculture, bringing with it agricultural machines, pesticides, fertilizers, bulldozers, and genetically engineered crops, but also access to education, health care, and other forms of welfare. The gravitational forces of these two bright objects at a certain moment in time crossed, and water has been largely incorporated into the orbit of the profit-driven market. Yet we argue that in the big picture, and in the long run, water may exercise a stronger influence on the economy—defined long ago by Polanyi as patterns of relationships with environment—than gold. The awareness of the presence of toxic substances in the water and in mothers' milk may constitute the first moment of this tour de force, which would hopefully permit searching for forms development compatible with health and conservation of biodiversity.

How does the awareness of the presence of toxicity in Yucatan waters and in Mayan women's blood and breast milk influence our understanding of the contemporary culture and politics in Yucatan? Traditional scholarship would answer that culture and toxicity have nothing to do with each other, yet we believe that, as Stacy Alaimo states, "human substance is inseparable from the environment," and also that the human substance and its environments, in their mutual entanglements produce stories and meanings that are ultimately constitutive of culture. We see these entanglements as dynamically transforming through fluxes of power that run through each and every relation and where oftentimes resistance becomes strong enough to push back and transform the traffic of objects, bodies, and substances that today circles around the profit-driven market.

While generalizations about cultures' environmental determinism in the nineteenth century led to racism justifying colonial "missions,"[2] and as such need to be rejected, there is no doubt that the environment and human practices influence each other in an array of complex ways. Illness that results from slow, toxic exposure transforms life practices and our understanding of the world and values. While environmental determinism in certain discourses is used to justify the alleged superiority of certain cultures over others, the opposite attitude, which examines the environment and human cultures separately, opens the door for yet another, if different, pattern of neocolonization, namely that of corporate rhetoric in which toxic substances are "disconnected functionalist molecules," considered only in their interaction with pests, as opposed to "extensive bundles of relationships" (Murphy) that they establish with surrounding worlds.[3] In other words, the desire to avoid thinking about the mutual relationships between culture and environment due to colonialist and racist associations may lead scholars in the humanities and social sciences to be excessively wary of adopting discourses of environmental justice and environmental health.

The landscape of environmental justice and environmental health analyses is complex and it is true that as Michelle Murphy states in some cases, indigenous communities are represented "as damaged and doomed, as inhabiting irreparable states that are not just unwanted but less than fully human." Aware of this danger, and unwilling to reproduce this pattern, we argue that even though indigenous communities are the most vulnerable in the polluted landscapes because not only their health, but also their very identity may be at stake, humanity's predicament as a result of toxic pollution is shared because even purified water contains high levels of toxic substances. As Murphy writes "what happens to the water is what happens to its relations. This includes you too." On the other hand, several of the Mayan communities that we encountered were rather "more than human" to us, protecting the few re-

maining zones of lower toxicity such as forests, lakes, and cenotes, as if they were guardians of human hope. Together with activists, foundations, and other allies, they return to agroecological milpa-like farming, thus constructing laboratories for a better future where our planet is not uniformly covered by toxic monocrops and killing its inhabitants with poisoned water. These indigenous and mixed communities, such as the association of beekeepers from Hopelchén, the agroecological school in Maní, Bacalar Group Kabi Habin, and so many others, seem to be the ones that are not doomed because they are active and aware. The winning 2014 volume of Mayan poetry by Pedro Pablo Chim Bacab calls for a distrust of European and North American economies of knowledge and summons the Maya to regain their cultural memory and to retake their lands and their ways of life.

Mayan Water

Anthropologists and historians debate if drought was the main cause of the end of the classic period of Mayan civilization, and some argue that it was a precipitation stabilization that had originally made possible Mayan cities' development (Iannone). Regardless of these debates, changing water dynamics must have been a crucial factor for Mayan culture as it is reflected in Mayan philosophy and rituals. For Yucatec Mayas, water is changing and alive, and human consciousness needs to be attuned to water. In Mayan culture, humans communicate with water and recognize that water responds emotionally (Macías). Syncretic religious transpositions led Mayas to associate the Virgin Mary with large bodies of groundwater and with Ix Chel, the Maya Goddess of rainbows, pregnancy, the moon, and groundwater. Today, Mayan people lead pilgrimages to "Our Mother" asking for a sustainable cycle of precipitation (Faust). In the Sacred Rain ceremonies taking place where forests meet the milpa, Mayan priests offer a turkey soup, bread, rum, cigarettes, incense, and a few drops of blood from a sick person to the Gods of the Wind in order to assure that they attend to the needs of the fields by bringing good rain (Faust). Today, sacred water sites are offered flowers (Macías), while in the past, human sacrifice was offered in the cenotes (Anda Alanís).

Today, the tourists visiting cenotes need to be cleansed by a Mayan shaman performing a ritual prayer and burning incense. This symbolic ritual to resist the spiritual contamination brought by Western civilization has, however, failed to protect the cenotes. Faced with the invisible toxins flowing from factory farms and fields where pesticides are applied to the subterranean water basin, the Yucatan populations, both native and nonindigenous have for many years been poisoned and sickened without realizing it. In parallel, or perhaps

as a part of this silent flow of toxins, inhabitants of rural areas have been assimilating discourses convincing them of the need to give up all of their traditional practices *en bloc* and take up industrial methods of growing crops and raising animals that involve uses of fertilizers, pesticides, and hormones.

The natural fragility of the Yucatan landscape is similar to that of human bodies; water permeates both the geological structures and the flesh. Yucatan does not have typical rivers; most of its waters are under the surface, forming subterranean rivers and channels. While Yucatan has the highest reserves of ground waters in Mexico, its porous geologic structure with karst soils makes the underground basin vulnerable to contamination (Bakalowicz). Karst is formed when soluble rocks such as calcium and magnesium carbonates dissolve, and underground drainage systems with sinkholes and caves develop. In Yucatan, there are more than four thousand sinkholes, in addition to faults and fractures interconnected to the groundwater (SEDUMA), through which pollutants enter (Marin and Perry; Escolero et al.; Marin et al; INEGI; Bauer et al.). Increasing deforestation of Yucatan (Andrade) that results from the extension of monocrops, further contributes to the contamination of water that is no longer detained by the roots of trees.[4]

Most of the pollutants emanate from intensive industrial agriculture and factory farms. These are compounds known as persistent organic pollutants (POPs)—organochlorine pesticides—widely used in agricultural and livestock activities that have high stability because of their resistance to chemical and biological degradations (Yang et al., 2009; Zahm and Devesa, 1995; Van Maele-Fabry et al., 2006) and that are likely carcinogens. Once these toxic substances get into the groundwater, they quickly become part of the human body. They are in the water people drink and use for cooking and growing food. Water flows through the bodies of animals, plants, and humans, connecting them in an essential part of their inter- and intracorporeal exchanges. Indeed, it is the carrier and the substance of what is toxic life. The profit-based market has hijacked the centuries-old sustainable economy built around water when this economy, including the water (itself now polluted) begins to be regulated by financial stakes. But there is another moment, perhaps less important in macroscenarios, but infinitely more significant in human life. When flesh perceives the consequences of the economy of gold, which has resulted in a scarcity of drinking water or when toxicity has led to cancerous mutations.

Maude Barlow and Tony Clark call water "blue gold," but the first scene of the documentary *Blue Gold*, based on their book, deconstructs the comparison of water to the precious metal (Bozzo). In these first scenes lasting just a couple of minutes, we hear the story of a Spanish explorer, Pablo Valencia, who in 1906, got lost in the desert between Mexico and California where he

searched for gold and had to spend a week without water. He began dying of dehydration when he was finally rescued. He later described the experience:

> Saliva becomes thick, lump starts to be forming in the throat, the tongue swells so large that it squeezes past the jaws, the throat swells so much that breathing becomes difficult creating terrifying sense of drowning, the face fills full due to the shrinking of the skin, many people begin to hallucinate, the eyelids crack and the eyeballs begin to cry tears of blood. (Bozzo)

While gold's value is constructed by human society, water is what life holds on to. Lack of water in the tissues leads a human or animal to a torturous death. Interestingly, in many cases of cancer, people also die of dehydration "due to distaste for fluids and inability to swallow" (Srivastava). In *También la lluvia*, the film's protagonist Daniel states in one of the last scenes that "no hay vida sin agua" (Bollaín) (there is no life without water). If the water is toxic, life transforms, sickens, and mutates, becoming cancerous and "cultura transgénica" in which the desire of gain takes over human well-being. But, in an individual life experience, such as Pablo Valencia's, water eventually retakes its place as the brightest object in the economy of life. In the moment of truth, when eyelids crack, gold has no value.

Toxicity

This essay is about pollution, understood as an introduction of contaminants to the natural environment that causes an array of changes that we argue are mostly adverse. Toxicity brought by the market, in the form of pesticides, fertilizers, and animal growth enhancers, remains in the water, as well as in human bodies. Heptachlor, lindane, endrin, dieldrin, endosulfan, and glyphosate are stored in the fatty tissue of human flesh and, since their molecules are very similar to those of human hormones, they begin to replace them. They are thus known as endocrine disruptors. Some constitute neurotoxins, others affect the respiratory system and cause skin ailments, and, most important, almost all are possible carcinogens and cause other immune system illnesses. Fertility issues, fetal malformations, neurologic disorders, and developmental delays have been attributed to these substances as well (WHO; Ledirac et al.; Alavanja; Faniband et al.). Acute intoxication—for example, if a container

of the pesticide breaks near a person—leads to vomiting, severe headaches, and even convulsions, followed by days of general malaise and possible skin burns. The use of organochloride pesticides causes more than three million severe intoxications and more than 220,000 deaths per year in the world (WHO; Ledirac et al.; Alavanja et al.; Faniband et al.).

These toxic substances are inscribed into social and economic relations governed by financial profits. They privilege monocrops over small farming, leading to the logging of virgin forests and ploughing over Mayan ruins to enlarge tillable fields. They work along with political and cultural discourses in which indigenous ways of life are looked down upon while simultaneously turned into touristic attractions. These chemicals are justified as necessary for a good life, progress, modernization, and prosperity, while they destroy biodiversity, pollute the soil, and, in the worst yet not rare scenario, ultimately make environments inhabitable except for the hardiest plants and animals, with humans migrating from the rural areas toward unstable futures in the urban metropolis, or to grow crops elsewhere where the environment is not yet destroyed and where there is unpolluted water and soil.[5] In other scenarios, slowly accumulating ailments leading to incurable disease are most common. For the last twenty years, Yucatan has been one of the areas with the highest numbers of cancers and birth defects in Mexico. Cervical cancer is the second most common fatal cancer (Ferlay et al.).[6] This high mortality rate is habitually related to poverty, marginalization, and low education levels, as well as insufficient access to health care (Palacio-Mejía et al.), but Polanco's research shows that the high number of cancers in the area is rather significantly related to industrial agriculture relying heavily on toxic pesticides.

Cancer is a complex disease that relates a sequence of genetic and environmental interactions. Gene-Environment-Interaction signifies combined influences of genetic and environmental factors on the disease process (Tabrez et al., 2014). According to most scientists, organochlorine pesticides (OCP) are environmental contaminants of major concern because of their persistence, bioaccumulation, and adverse effects on humans and the environment (Carvalho; Jung-Ho and Yoon-Seok; Khwaja et al.; Mrema et al.; Ruiz-Suarez et al.). The exposure to pollutants under certain environmental conditions have effects in genetic polymorphism, promoting disease initiation. Gene environment interaction involves the different effects of environmental exposure and the different effects of a genotype in people with different histories (Docea et al., 2017; Tabrez et al., 2009; Tabrez et al., 2014). This means that not everyone will react in the same way, some being more resistant to toxins, while others falling sick sooner.

Polanco et al. ("Risk") assess levels of pesticides in water and the potential risks to the environment and public health. The geographical distri-

bution of the study area overlaps with the semicircular path of the Ring of Cenotes (see Figure 1).

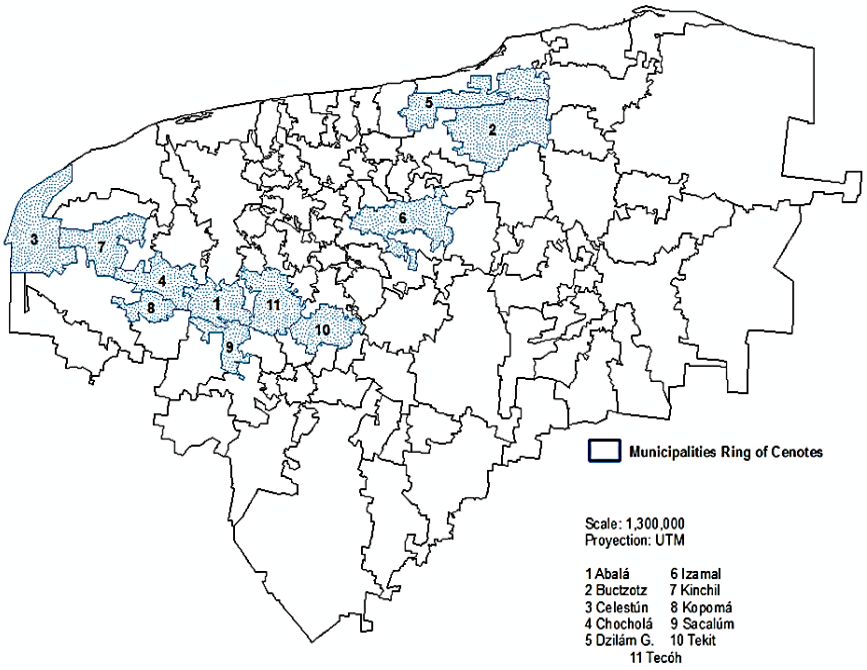

Figure 2. Study of Pesticides in the Ring of Cenotes (Sinkholes).
Polanco et al., 2015a.

The results show a high degradation of water quality in the recharge area, at the center of the state, and in the discharge coastal areas to the Gulf of Mexico, with high concentrations of heptachlor and lindane. Heptachlor is an organochlorine compound used as an insecticide whose safety was memorably questioned in Rachel Carson's *Silent Spring* and forbidden in the United States in 1980. Due to a very stable structure, it is a persistent environmental pollutant, and was classified by the Environmental Protection Agency (EPA) as a possible carcinogen (California EPA). Lindane, also an insecticide, is a neurotoxin, harmful to human kidneys and liver, and also classified as a carcinogen and a persistent environmental pollutant (California EPA; IARC, "Monographs"). Exposure to heptachlor and lindane as well as other toxic chemicals affects the health of the Mayan communities because 30 percent of

the Maya population drinks polluted water from wells and sinkholes (Polanco et al., "Risk"; Polanco et al., "Contamination"). Polanco (2017a) shows that the Cenotes are polluted by organochlorine pesticides at concentrations far above the maximum permitted levels according to the Mexican official standards (SSA). At the same time, these standards are much less rigorous than the norms enforced by the European Union or the World Health Organization (WHO) (Li and Jennings).

The study of bioaccumulation of pesticides in the blood of Maya women with cervical uterine cancer was conducted in eighteen municipalities in Yucatan, known for the high mortality rate of cervical cancer (Figure 3). This area includes the main livestock zone in the northeast, the main agriculture zone in the south, and the metropolitan zone of the State.

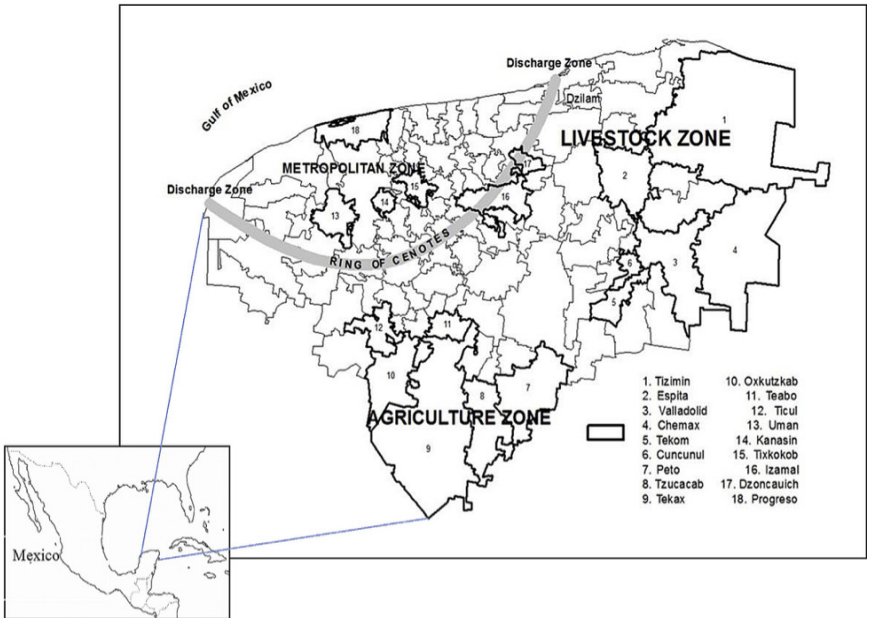

Figure 3. Study of Pesticides in Blood of Women with Cancer in Eighteen Municipalities in the Livestock, Agriculture, and Metropolitan Zone of Yucatan State. Polanco et al., 2017a.

The results of Polanco et al. (2015b) show that OCPs were detected in the blood of 72.2 percent of Maya women in the main agricultural area in the west of Yucatan, living in livestock, agricultural, and metropolitan areas. The highest OCP concentration was registered in Tizimin, in the livestock region,[7] with high levels of OCP detected also in the areas of Dzoncahuich and Espita.[8]

The agricultural area (Peto) was the second-most contaminated.[9] The metropolitan area (including Kanasin and Progreso) had a similarly high frequency of detection for some of the above-mentioned substances.[10]

The results of an analysis of bioaccumulation of levels of pesticides in the breast milk of healthy Maya women in these municipalities are represented in Figure 4[11] and they point to deeply concerning high levels of toxic chemicals in infant nutrition.[12] In the metropolitan zone, in the mothers' milk, heptachlor epoxide (18.43 ppm) was detected, a substance even more toxic than heptachlor, characterized by a similarly long life. Additionally, studies show that infants are fed with endrin (1.92 ppm), yet another insecticide and neurotoxin affecting the human nervous system that is very difficult to detect unless present in very high doses, which is the case in the studied population. Mothers' milk in the metropolitan area (near Merida and Progreso) also contains dieldrin, an insecticide, which is very hard to break down and linked to Parkinson's and breast cancer (Ascherio). In the main agricultural zone and in the west coast area, heptachlor (0.178 ppm) and endrin (0.127ppm) surfaced again. Beyond these chemicals, in the agricultural zone, near Peto, Polanco et al. (2017a) detected endosulfan II (2.10 ppm). This is a highly controversial agrochemical of a very acute toxicity, classified as persistent organic pollutant (POP) due to its high bioaccumulation, potential as endocrine disruptor, and its implication in the disappearance of species, including honeybees. For years, endosulfan was forbidden in many countries, and in 2011, a global ban of this substance was negotiated under the Stockholm Convention (see Table 1). Yet as Polanco's study shows, it is still used in Yucatan.

Besides heptachlor, endrin, diendrin, lindane, and endosulfan, in the southern areas of the state of Yucatan, and in Campeche, Quintana Roo, and Chiapas since the late 1990s, glyphosate's use has increased significantly together with the growth of area under Roundup Ready soy, which is genetically engineered (RR-soy). Glyphosate is the main ingredient of Roundup and is an inalienable companion of RR-soy, which is unable to compete with weeds without this pesticide. There is strong circumstantial evidence from Argentina that the use of Roundup is related to the increased rates of cancers (Alvarez Vázquez, 2014, 2015; Government of Chaco Report; Beilin and Suryanarayanan). Glyphosate has been recently recognized as a possible carcinogen by the World Health Organization (International Agency of Cancer Research).

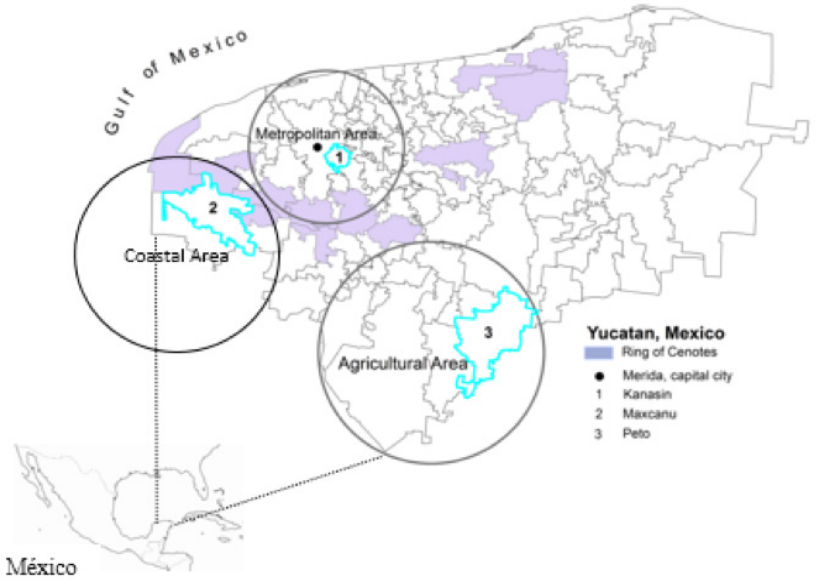

Figure 4. Study of Pesticides in Breast Milk: 1) Metropolitan Area (Kanasin); 2) Coastal Area (Maxcanu); and 3) Agricultural Area (Peto). Polanco et al., 2017b.

Needless to say, the detected levels of OCP represent serious risks to women and children's health in the region.[13] The question is if they should really be simply called "risks," as they are commonly dubbed in the scientific papers. Even if not everyone gets cancer, the OCPs that enter bodies through water and also air through oral, dermal, and nasal routes, are having some adverse effects on all life forms, which is what poisons are designed to do. Excreted through breast milk that is assimilated by the infant (Dahmardeh et al.), they may affect the child's neurodevelopment (Roberts and Karr), produce slow growth, and may cause other adverse effects such as low birth weight.[14] While the use of "may" in the previous sentence may be debatable, a consideration of what kind of citizens are born in this toxic culture is significantly missing from the scientific reports. When we ask "what kind of human beings grow up drinking toxic milk from the first moments after birth?" we may be asking a question that refers not only to Mayan infants, but also, to a degree, to all of us.

Cultures of Trust, Risk, and Destruction

In some discourses, the Maya's lack of knowledge of how to handle agrochemicals is blamed for their health damages. This lack of awareness of the health and environmental effects of pesticides is, so the argument goes, due to the poverty, low levels of education, and the marginalization of Mayan people. We argue that not only Mayan people, but rather most of us are not aware of the dangers posed by the chemical properties of the pesticides, and that this is not simply a result of lack of education. Beilin and Suryanarayanan analyze narratives of Mayan and Mennonite farmers that show that they are similarly misinformed by the pesticide distributors who assure them that these substances "no hacen nada" (do not do any damage). While state and federal institutions do not provide programs to teach agroecology or even safety in the use of pesticides, representatives of pesticide companies come to farmers' homes and leave them free samples, arguing, for example, that these "líquidos" (liquids), as they call herbicides, "secan bien las malezas" (will dry out weeds efficiently), or that they will make animals grow bigger, thus contributing to farmers' profits. What people who sell pesticides, considered by the local population as agrochemicals experts, never mention (and what is insufficiently emphasized by the media) is that the substances that they sell are directly connected with the advent of various ailments in humans, greater resistance of weeds, deforestation, biodiversity die outs, and loss of soil fertility. As Krimsky and Gillam state, reacting to the court release of the document obtained from the litigation against Monsanto over its herbicide Roundup: "many corporations view science not as a generator of truth, but as one of many inputs into production." Scientists' alliances with corporations and corporations' alliances with media complicate the landscape of what is scientific expertise, true scientific knowledge, and, consequently, what is a "lack of knowledge and education" and "marginalization." It appears as if these alliances between corporations and science marginalize a great majority of modern society from the knowledge of the effects that pesticides have on our health and lives, while the humanities' reluctance to think through these connections and conflicts of interest make us unaware of how they are inscribed into modern culture's values.

Rural cultures have traditionally been based on trust—the mutual trust of the members of the community—but recently, and precisely with modern education, a trust in science, technology, and their representatives, often called "experts," has been widely developed during the twentieth century in countries like Mexico, governed by a modernizing centralist bureaucracy. How can farmers be aware of the health effects of pesticides if even scientists themselves disagree, and scientific controversies, often due to a conflict of interest,

are very frequent in research on pesticides? Substantial disagreements remain about which substances are risky, how risky they are, and what to do about them. Various scientists' research is funded by the very agrochemical companies whose products they review. At the same time, various people employed by scientific institutions, and even more, those working for corporations that commercialize technologies, do not belong to the culture of trust, but rather to the culture of risk, where a number of ethical breaches, including manipulation of trusting customers, are seen as necessary for increasing profits. The contamination of water, soil, and human bodies has its parallel in the process of the misinformation, manipulation, and betrayal of public trust. In this context farmers' perception of the risk of pesticides for the environment, water purity and their own health has been hijacked and manipulated by the transforming context of power dynamics that they are facing.

Explaining how the industrial agricultural setting has transformed Mayan peoples' relationship with the water, Matul writes, "En ningún caso ha cambiado la relación cósmica con el agua. Lo que ha cambiado, son las relaciones de poder, pues el estado impuesto arbitrariamente se ha enseñoreado del agua y la utiliza para su propio beneficio y el beneficio de las grandes compañías internacionales" (qtd. in Lepe) (Their cosmic relation with water has not changed at all. But power relations have changed as the state has taken over water resources and uses it for its own benefits and for the benefits of big international corporations). Power comes, like it did when the first colonizers arrived, with biochemical agents, such as viruses, bacteria, and toxins that weaken life in the rural and wild areas so that land can be more easily taken over for industrial exploitation. Toxic substances are part of assemblages of technology, including bulldozers that flatten forests and tractors and combines that run along the fields shuffling the soil for years, and sow it persistently with seeds that are state-subsidized or well-priced on national and international markets. This is the traffic brought to life by a profit-based economy in which everything gravitates around money.

Toxic agriculture has transformed the environment, human practices, and beliefs, leading ultimately to the destruction of the local culture, which, unable to adapt to the poor conditions, resettles into new contexts. While traditional Mayan milpa-based agriculture was based on the idea of reciprocity and respect, in which soil was "generous" and fed people without the input of agrochemicals, the modernizing cultural discourses have transformed the current conditions. Now water, soil, and human bodies are sickened by the toxic chemicals and need to be "cured" with yet different ones. Tony Weis calls this dynamic, in which negative side effects of toxic agriculture are treated by yet new chemical solutions, an "override" that leads to a vicious cycle of higher and higher accumulation of pollutants. The accumulation of overrides leads

to an instability that in individual lives, is resolved eventually by death, but in planetary life, may occur by a return to the economy in which treasuring water is more important than the search for profits.

Conclusion: Resistance, Resurgence, and Hope

We started this essay with questions of what our awareness of the high levels of heptachlor and lindane in Mayan women's breast milk do to our understanding of today's Yucatan culture. We showed that these levels of pollutants are markers of toxic modernity in which the toxic substances privilege organisms that bring profit at the expense of all other forms of life, which are forced to wither, relocate, or mutate, and that this state of affairs, even if absurd, acquires a status of normality, modern necessity, and rational way of life. We expressed awareness that scholars who practice traditionally delimited disciplines would say that culture and water pollution belong to different fields of knowledge and thus are not related, and we discussed this separation as complicit with the status quo, in which corporations discuss toxicity in relation to pests, and do not see its relevance for society, politics, and culture (which are indeed inseparable from health). We argued that for environmental cultural studies, the passage of toxins between bodies of water, soil, and human flesh, and the resulting illnesses and struggle for health are deeply significant processes in which culture becomes transformed by an economy in which gain is more important than health and well-being.

To conclude, we need to discuss as well how, as a part of these processes, resistance against toxicity emerges, and various hybrid alliances of activists, scientists, Mayan leaders, and international foundations begin a struggle to detain the flow of pollutants. During the last decade, research such as Polanco's in Yucatan or Remy Vandame's in Chiapas, as well as new research groups from UNAM (National Autonomous University of Mexico) has attracted the attention of international organizations such as ONU, UNESCO, and the International Organization of Human Rights of the OEA, among many. This has created conditions for engagement of international foundations, which through grants, help empower community leaders and indigenous associations. Various new social movements, however, raise funds without any outside support regardless of their precarious financial situation. Their initiatives include agroecology, legal action to protect forests, protests, and manifestations against the construction of factory farms. All of these measures stop the progress of heptachlor, lindane, glyphosate, and other toxins by establishing protected areas and detaining construction of new factory farms and the progress of bulldozers. In that tension between contamination, imposed

by the corporations, and newly born array of resistance movements, a new consciousness of freedom emerges.

In this new consciousness, freedom is made possible through the protection of what anthropologists Wolfgang Kapfhammer and Gordon Winter call "zones of slow disturbance" and, we would add, also low toxicity, because passively allowing toxicity to penetrate our tissues turns us into victims who lose agency through illness and death. Freedom is produced by detoxifying land and agricultural practices, by teaching agroecology to farmers currently practicing industrial agriculture, and by establishing an oasis of agroecological plantations and schools.

In this new resurgent culture, emerging from the awareness of death and destruction brought on by toxicity, traditional indigenous practices, such as Milpa, or Meliponiculture, are reconsidered and reintroduced. This reemergence of traditional practices awakens indigenous Mayan memories, pride, and awareness of the necessity of resistance. This awareness involves a struggle to distinguish between allies and opportunists, and between helpful and toxic technologies. Ultimately, the new culture constructed in these movements is a hybrid conglomerate of ancient customs such as polyculture of milpa and twenty-first-century knowledges and values, based on consciousness of human rights as rights to clean water and health, and also based on rethinking and reinterpreting the meaning of the Mexican constitution declaring that the State should be protecting the well-being of the population. Angel Polanco's research group is proposing to consider the toxicity of water in the context of various national and international conventions, asking that the passive allowance for pesticide pollution be considered as a violation of human rights.[15]

Economic theory that states that certain levels of pollution are justified by human pleasures derived from consumption of certain products is questioned by ecological economics. Daly and Farley imply that in the current historical moment resources, including clean water and air, are so scarce, that polluting them further will bring adverse effects of such seriousness that no pleasure that derives from profit and consumption can outbalance them.

While a resurgence of awareness and resistance is the source of hope in our conclusion, and while we believe as Faust (165) did almost twenty years ago that "the future of the Maya will be closely linked to the future of their forests and fisheries, their milpas and orchards, houseyards, and domestic animals," and we deeply believe that relearning sustainable and nontoxic relationships with environment is the foundation of well-being for all human future, we recognize that we do not have reasons to be optimistic.

On June 5, 2018, while everybody's attention was taken by the World Cup, the Mexican government signed ten decrees that eliminated protection of three hundred water basins containing 55 percent of the available water in

the country. From now on, there will be no legal obstacles for concessions to corporations needing water for their industrial ventures such as fracking, mining, soft drink and beer production, and others. Even if the government declared that no concessions would be granted before upcoming elections, various sources recognized the new law as de facto privatization of 55 percent of the national waters. In the preceding years, water politics has been consistently inconsiderate of socio-environmental needs. The federal budget for water treatment was decreased by 72 percent between 2016 and 2017 (Biggio). As we write this essay, López Obrador, who promised to heal Mexican agriculture by bringing subsidies for agroecological production and family farming, is celebrating his victory. We hope that the new government acts on these promises and that in six years, water and breast milk in Yucatan will be less toxic.

Table 1: Regulation of Pesticides in Stockholm Convention

Pesticide	**Condition**
Aldrin	Elimination
Dieldrin	Elimination
Endrin	Elimination
Heptacloro	Elimination
Lindano	Elimination
Endosulfan	Elimination
Hexaclorobenzene	Elimination
DDT	Restringed

Source: Stockholm Convention, "All POPs Listed in the Stockhold Convention," 2008, http://chm.pops.int/TheConvention/ThePOPs/AllPOPs/tabid/2509/Default.aspx

Notes

1. Cenote is a deep sinkhole in limestone with a pool at the bottom, found especially in Yucatan.

2. Discourses and practices of bodily purity, of course, have been deployed for misogynistic, racist, and colonial ends. Indeed, some prevalent discourses in environmental humanities celebrate contamination, in the figure of the cyborg (Haraway), and the very idea of the transcorpreality (Alaimo). From this standpoint, maybe contamination *per se* is not necessarily toxic; the drive for purity can be toxic as well. What binds cultures of toxicity (such as rampant masculine toxicity) and environments of toxicity (enabled by agrochemical and industrial agents) are the disproportionate consequences they have for various lives, both nonhuman and human.
3. Rather than a unilateral conditioning, our vision is one where objects exercise multifarious influences at each other, and where the strongest forces meet resistance that recycles fluxes of power through the network. Yet, unavoidably there are conditionings. Conditioning is a serious philosophical problem for humanities' and social sciences' thinking. Reading Thomas Nagel's essay on "Moral Luck," we observe how each and every human action is conditioned by a previous chain of factors to the extent that, in the end, free will appears as mere illusion. Yet, obviously, as Nagel concludes, this is not an argument to give up the idea of free will on which all the constructions of justice and ethics depend. Rather, the awareness of the complex network of conditionings, where each agency is a hybrid and distributed agency, is needed for a more realistic and humane politics.
4. Clearing of the fields for agriculture has resulted in flooding while droughts are also more severe. Weeds have become more aggressive, which increased the indiscriminate use of pesticides. In some cases, farmers returned to more traditional methods, in others they have abandoned or sold destroyed lands and moved their tractors to newly purchased territories (Faust). Faust describes further consequences of industrial agriculture in Campeche in the following way: "The bulldozers that cleared the land also erased the Maya canal that brought rain safely from the hills to the town's pond/reservoir. The frogs have nearly disappeared from this area and the town's pond dried up last year in the dry season, having accumulated the soil washed from the "mechanized plot" during the rains of the past seventeen years (Faust).
5. Faust tells the following story of a certain locality where this assemblage of technologies pertaining to industrial agriculture was introduced: "One massive project in the state of Campeche cleared more than 700,000 ha of intact forest for a rice-growing project that failed, leaving a huge area that will not return to forest. Soils have been degraded, seed rain is too far away to re-seed the area naturally; no stumps, roots or stones were left to keep the soil from being washed down the vertical cracks in the limestone subsoil when the rains came each year. The herds of deer and peccary, the flocks of wild turkeys and ducks, the schools of fish in seasonal streams and ponds, the caimans, jaguars, and mountain lions that preyed on them all have nearly vanished from this area that was wetland forest mixed with savanna. Not even the traditional cornfields succeed any more in this area. The weeds have become 'horrible,' due to acidification of the soil from years of intensive use for rice. . . . What remain are cattle, and a few sheep and goats, with a remnant human community to care for them. Cattle

require far fewer workers than rice fields or cornfields. In the 1980s, migrants from this area were leaving for the City of Campeche, by the 1990s they were heading for Merida and Cancun, by 2000 they were beginning to migrate illegally into Texas. First to leave were the children of the colonists, already loosed from the soil of their ancestors; then, the adult children of Maya communities began to follow them on the second-class buses that connect villages to cities, Caribbean tourists, and ultimately to the national frontier and beyond."

6. In Yucatan, the national average mortality rate of cervical cancer was 29.02 per 100,000 during 1990–2005 (Figure 1) (SSY). During 2006–2010, Yucatan was the second state with cervical cancer–related mortality with ninety-four deaths in 2010 (SSY, 2011). Overall, over the period 1990–2010, Yucatan had the highest mortality rate.
7. In Tizimin, high levels of pesticides in blood of Maya women with cervicouterine cancer were detected, endosulfan I (7.35 µg/mL), aldrin (3.69 µg/mL), 4,4' DDD (2.33 µg/mL) (derivate of DDT), and 1.46 µg/mL of δ-HCH (lindane).
8. Including 1.39 and 0.347 µg/mL of ɗ-HCH, 1.28 µg/mL of heptachlore, 1.15 µg/mL of endrin aldehyde, and 0.94 µg/mL of 4,40 DDD.
9. Women from Peto in agriculture area had high levels of OCP residues in blood with 1.25 µg/mL of dieldrin and 1.26 mg/mL of 4,4' DDE. There were also reported levels for heptachlor (0.182 µg/mL), endrin (0.148 µg/mL), ɗ-HCH (0.506 µg/mL), g-HCH (0.479 mg/mL), 4,40DDD (0.250 µg/mL), and metabolites like endosulfan sulphate (0.260 µg/mL).
10. Dieldrin and endrin, HCH, heptachlore, endosulfan I, II, endosulfan sulphate, DDT, and their metabolites.
11. Breast milk samples, obtained from rural Maya women, from municipalities of Yucatan, Mexico, were obtained for organochlorine pesticides by gas chromatography analysis.
12. The study of pesticides in breast milk of Maya women, from municipalities of Yucatan, Mexico, were obtained by gas chromatography analysis. The samples served to identify and quantify high levels of OCP: 18.43 mg/kg of heptachlor epoxide and 1.92 mg/kg of endrin in the metropolitan zone; 2.10 mg/kg of dieldrin, 0.117 mg/kg of endosulfan II, 0.103 mg/kg of heptachlor, 0.178 mg/kg of endrin, and 0.127 mg/kg of endrin aldehyde in the main agricultural zone and on the west coast (Polanco et al., 2017b).
13. The presence of OCP in human biomarkers such as breast milk or blood, and in environmental samples such as water, soil, or air, has been studied for years in many countries as potential public health risk. However, studies in Latin American have been scarce (Rojas-Squella et al.).
14. Human breast milk is considered an adequate medium for investigating OCP exposure of both the general population and breastfed infants (WHO). The concentrations of these biomarkers are a good indicator of environmental contamination on public health (Díaz-Barriga et al.; Ribas et al.; Sharpe and Irvine), and the maximum resi-

due limits (MRL) are established in the Codex Alimentarius of the FAO/WHO and IUPAC.

15. Apart from the Mexican Constitution and the Constitution of the State of Yucatan, among these are the Yucatan Law for the Environmental Protection of Cenotes and Caves, the United Nation Convention for Water from Mar del Plata, the Convention to Eliminate Discrimination against Women, the Convention on Rights of Children, the Convention on Water and Sustainable Development, and various others.

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