Beyond Pesticides: Protecting Health and the Environment with Science, Policy, and Action

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Pesticides *and* You

The Coronavirus Chronicles

Where Do We Go from Here?

In this special issue, "The Coronavirus Chronicles," we address the science, policy, and advocacy that have emerged during the COVID-19 pandemic and bring together some of what we are learning during this national tragedy. As we know, the virus has taken an unthinkable death and disease toll on families and the nation, forcing a cascade of destruction to our educational system, economy, and social networks. Public attention to the killing of George Floyd at the hands of police, a parallel national tragedy that is not new and also still ongoing, has clearly exposed the serious societal problems associated with racial inequity. National discussion on this has led to greater understanding by the public at-large of disproportionate risk and environmental racism throughout our society.

While Mr. Floyd's killing has laid bare institutional racism and structural problems with the distribution of wealth and the meeting of basic human needs in the U.S., the Covid-19 pandemic brought to national attention essential scientific understandings that must be applied to policy—if we are to meet the challenges of environmental collapse associated with biodiversity decline and the climate crisis. Whether addressing social ills or environmental insults, during this period we are being taught in real time that solving these existential crises demands that we act holistically, or systemically, and address complete ecosystems and social systems, and their interrelationships. Only then will we survive and thrive.

Science supports strategy

The science articles cited in this issue capture our failure as a society to take seriously scientific findings. The articles are the warning signals of systemic disruption of ecosystems and human health, providing us with a roadmap for a sustainable path forward. For example, knowing that quaternary ammonium and other toxic compounds in common disinfectants bring harm to our respiratory, neurological, and immunological systems, informs the need to seek out alternative strategies, already available on the market, for managing the virus. With the rollout and updating of our *Safer Disinfectants and Sanitizers* webpage, we point to nontoxic strategies for returning children to school safely—in terms of school infrastructure changes, ventilation, safer products, distancing, and mask-wearing. Similarly, we report on a local food hub created in Maui (HI) to provide a local market for farmers who previously served hotels closed by the pandemic, while providing food security for communities.

Taking a systemic approach

We must widen the lens even further and recognize that the experiences of the past year cry out for broader and deeper systemic change—requiring that we look at the interaction of all the pieces that allow the system to work. Some important teachings about the COVID-19 pieces include: different population groups have disproportionate vulnerabilities, from children to older people; essential workers (from hospital personnel, to grocery store workers, to farmworkers) suffer elevated risk factors due to exposure patterns, creating disproportionate rates of disease; those with preexisting conditions or comorbidities face higher risks; and a lack of complete scientific knowledge requires a precautionary approach or standard. In this spirit, we must evaluate the introduction of toxic pesticides, which are developed to disrupt biological systems. As a part of ecosystems, from humans to microbial life in the soil or mayfly nymphs (keystone species at the bottom of the aquatic food web), we coexist and depend on each other.

Organic as systemic change

Given all the complexities associated with a truly holistic or systemic analysis, it also means that we must redouble our efforts to develop and adopt alternatives that eliminate the production and use of these toxic materials. It is unconscionable to continue tweaking restrictions on pesticides with known hazards and broad uncertainties about the effect of mixtures, synergistic effects, and cumulative risk associated with location, occupation, and demographics—given the availability of organic systems that can now and increasingly in the future eliminate those hazards economically and solve the looming environmental threats.

This issue highlights some of the critical elements necessary to advance foundational change in the arena of toxic pesticide dependency and alternatives, the importance of holding corporations and government at all levels accountable to scientific facts, the need to advance individual chemical bans only in the context of a shift to eliminate all toxic pesticides that disrupt life, and the opportunity to do this through the continuous improvement that organic systems offer right now.

As Martin Luther King said in his speech, "Where Do We Go From Here?," to the Annual SCLC Convention in Atlanta, Georgia, August, 16, 1967: *"[W]e must walk on in the days ahead with an audacious faith in the future"*—and, I would add, demand that all policy governing health, welfare, and environmental protection embrace a holistic and equitable approach to systemic change.

We extend our best wishes for a transformational new year!

Jay Feldman, executive director of Beyond Pesticides

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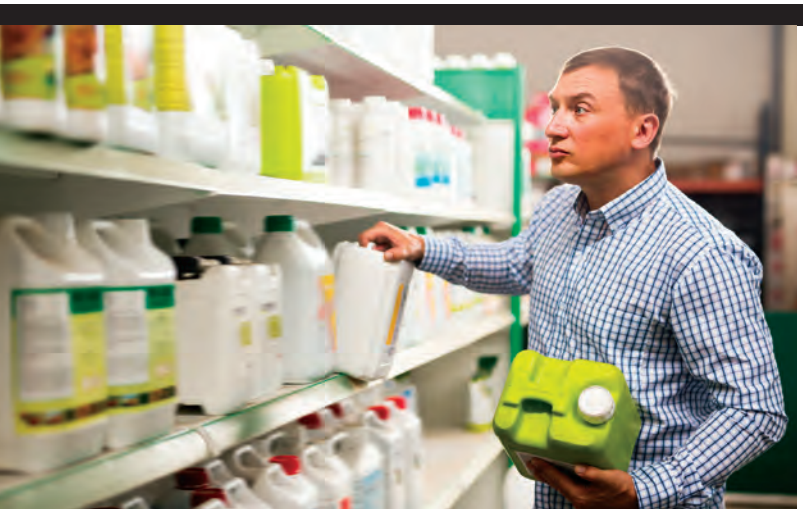

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Secret "Inert" Ingredients Are Not Innocuous

I always thought that the "inert" in inert ingredients on a pesticide label specifically meant inert to plants, without reference to humans. Some googling pulled up a definition in federal pesticide law defining inerts as "an ingredient which is not active." Can you provide more info on what these chemicals are?

Bruce, ME

Your research pulled up the correct definition, but the reality is that in terms of human health, inerts (sometimes called "other" ingredients) can be just as toxic as the "active" ingredient in a pesticide product, both to plants and animals. These chemicals can be biologically and chemically active, but are not added to the product formulation for the purpose of attacking the target pest (e.g., insect, weed, or fungus). Inerts are generally used to enhance the active ingredient, and are employed as antifoaming agents, surfactants, propellants, or a number of other uses. The U.S. Environmental Protection Agency (EPA) does not require manufacturers to disclose the inerts used in any particular pesticide product. They are considered confidential business information (CBI).

EPA does have a database that lists all the possible chemicals used as inert ingredients. However, the range of potential materials makes this tool useless when looking at the pesticide products sold on store shelves, which can contain up to 99%+ inert material. An investigation by the Attorney General of New York, *The Secret Ingredients in Pesticides: Reducing Risk* (Abrams, 1991) found that inert ingredients typically make up 95% of product ingredients.

EPA allows hazardous chemicals like formaldehyde, quaternary ammonium compounds, and hydrochloric acid to be given the same "inert" designation on a pesticide label as materials like sunflower seeds, cocoa, and canola oil. As an average consumer, you can try contacting the manufacturer to find out what is in a pesticide product. Chances are, the chemical manufacturer will not share that information. Under federal law, medical professionals can get information on full pesticide formulations to treat patients, but are typically required to sign a confidentiality agreement with the product manufacturer.

Independent testing recently conducted by Public Employees for Environmental Responsibility (PEER) finds that the popular synthetic pyrethroid mosquito pesticide Anvil 10+10 contains significant levels of cancer causing PFAS (per- and polyfluoroalkyl substances), known as "forever chemicals" because of their persistence in the environment. PFAS is being found to contaminate groundwater, surface water, and drinking water throughout the U.S. EPA's inerts database lists these substances, but the agency claims they are not being used in any formulation. This raises another serious problem of contaminants that are integral to pesticide products as a result of the manufacturing or packaging process, yet not disclosed on the product label.

EPA does not evaluate the toxicity of pesticide products in the form sold to consumers, or as full formulations, on store shelves. Under federal pesticide law, the agency is only required to test the active ingredient in the formulation.

Advocates note that EPA has the power to require public disclosure of inerts. Beginning in 2006, Beyond Pesticides joined with other groups to sue EPA on this issue. In 2009, the agency issued a promising response, indicating it would initiate rulemaking and seek public input on an inert disclosure law, but took no further action. Groups sued for undue delay, and EPA responded by backtracking and withdrawing from the rulemaking process on this. In 2016, the agency disclosed and delisted 72 inerts that it said were no longer in use. Despite the agency's recent indication that PFAS is not currently in use as an inert, it has not been delisted.

While PFAS is the most recent example, there are numerous inerts of concern, identified after independent research. For example, one of the most hazardous ingredients found in the commonly used herbicide Roundup (active ingredient glyphosate) is polyethoxylated tallowamine (POEA)—a surfactant, which is classified as an inert and therefore not listed on the label alongside glyphosate. POEA can kill human cells, particularly embryonic, placental, and umbilical cord cells.

Rules mandating full disclosure of inert ingredients and other contaminants on all pesticide labels is needed. We hope that provides some clarity on the real dangers behind pesticide products' "inert" ingredients that are usually anything but inert.

SHARE WITH US!

Beyond Pesticides welcomes your questions, comments, and concerns. Have something you'd like to share or ask us? We'd like to know! If we think something might be particularly useful for others, we will print your comments in this section. Mail will be edited for length and clarity, and we will not publish your contact information. There are many ways you can contact us: Send us an email at *info@beyondpesticides.org*, give us a call at 202-543-5450, or send questions and comments to: 701 E Street SE, Suite 200, Washington, DC 20003.

Pesticide Burdened Body

I'm dealing with health effects that I think are caused by pesticides—my neighbor sprays their lawn and my community is constantly "fogging" for mosquitoes with a toxic spray. I feel sick and want to test to see whether I have pesticides in my body. Can you provide contact information for a laboratory that does this or any resources I can use to find out more information?

Sarah, IL

It is important to note that Beyond Pesticides staff are not medical practitioners, and the best route to prevent and address illness is by working closely with a doctor and other medical professionals. At the request of members and supporters like yourself, we can provide a list of doctors and other resources that the organization maintains.

There is no doubt that pesticide-related illnesses are on the rise. Beyond Pesticides' *Pesticide-Induced Diseases Database* (*bp-dc.org/PIDD*) lists hundreds of scientific studies linking pesticide exposure to ailments that are all too common. Much of this is likely the result of the toxic soup of hazardous chemicals that are ubiquitous in modern life—from the food we eat, the air we breathe, and the water we drink.

Testing for pesticide contamination, or body burden testing, is best done in coordination with professionals who can help interpret your results. For the past 20 years, Commonweal in Bolinas, CA (commonweal.org) has run a biomonitoring resource center that measures the presence and concentration of chemical compounds in the human body. Commonweal also operates a health and healing retreat center.

For individuals with medical conditions believed to be related to environmental exposures, or for those experiencing greater sensitivity to chemicals in their environment, the Environmental Health Center-Dallas (ehcd.com) has a long history of diagnosing and treating patients. It lists itself as "A complete testing and treatment facility for environmentally-sensitive adults and children." Claudia Miller, M.D. (*new.drclaudiamiller.com*) is one of the world's foremost experts on environmentally-induced diseases and has a range of resources on her website for those who may have Toxicant-Induced Loss of Tolerance (TILT, sometimes referred to as Multiple Chemical Sensitivity, or MCS). For those specifically concerned about glyphosate exposure, Health Research Institute (*hrilabs.org*) specializes in testing people, pets, water, and other sources for the toxic herbicide.

If looking for testing outside of these resources, it is important to coordinate with a doctor, use a state certified lab, and know the list of compounds being screened. Some labs will only test for the presence of persistent "legacy" pesticides like DDT/DDE, dieldrin, and other organochlorines. While a significant detect on these older chemicals can provide some insight, many of these compounds are ubiquitous in our environment—according to the Centers for Disease Control and Prevention, most of the U.S. public has some level of DDT/DDE in their bodies. There are thousands of pesticides registered by EPA, in addition to inerts, contaminants, and other industrial chemical compounds. Even the most comprehensive test may not be able to detect every hazardous compound to which you may have been exposed.

We hope your health improves and that this information will help you along that path. For further resources, please email Beyond Pesticides at *info@beyondpesticides.org*.

FROM THE WEB

Beyond Pesticides' Daily News Blog features a post each weekday on the health and environmental hazards of pesticides, pesticide regulation and policy, pesticide alternatives and cutting-edge science, *beyondpesticides.org/dailynewsblog*. Want to get in on the conversation? "Like" us on Facebook, or "Follow" us on Twitter! *facebook.org/beyondpesiticides*, *twitter.com/bpncamp*.

Excerpt from Beyond Pesticides Daily News Blog (3/12/2020): Washington Farmworkers Harmed by Pesticides Walk Out, Demand Justice. Farmworkers walked out of an orchard in Sunnyside, Washington in March to demand improved working conditions. Over a dozen individuals cited unacceptable issues, such as toxic pesticide exposure, unfair wages, and lack of paid breaks.
Theresa comments: As an environmental educator and field biologist, a parent, and a citizen who cares about environmental justice, I support the farmworkers' demands for better conditions and protective gear. Some of the pesticides—which EPA should have banned by now—are extremely hazardous. Not only are the farmworkers themselves exposed, but frequently their families, who tend to live nearby, may be exposed to pesticide "drift." Pregnant women, nursing mothers, and children are especially vulnerable to the toxic effects and do not know when this exposure may occur.

Excerpt from Beyond Pesticides Daily News Blog (5/15/2020): Glyphosate in Roundup Linked to Parkinson's Disease. New research out of Japan's Chiba University suggests that exposure to glyphosate, the active ingredient in the most commonly used pesticide worldwide (Roundup/glyphosate), may be a risk factor in the development of Parkinson's Disease. The ubiquity of glyphosate use in agriculture—which leaves residues of the toxic chemical in food—may mean that exposures to it represent a significant risk factor for the disease.
Jerilyn comments: My husband was an avid gardener and also used Roundup for many years. He passed away due to Parkinson's, but now I think that his use of Roundup was actually the cause of his death.
Rebecca comments: My husband has Parkinson's and he has used Roundup every summer for 30 years.

Regulatory Failures Mount, Threatening Health and Safety

The complexities associated with regulating pesticides with complete information to a standard of safety that is protective of all populations groups by age, sex, gender, race, ethnic identity, location, and occupation are beyond the reach of the U.S. Environmental Protection (EPA) and the state agencies. Pointing to the fact that a pesticide is regulated by EPA has become less meaningful over time in the face of the complexities of exposure and individual vulnerabilities or comorbidities. EPA decisions of the last several years have brought into focus many of these deficiencies and has contributed to the urgent need to transition society away from toxic pesticide use. The following represents some of the EPA decisions that undermine public safety just since July 2020.

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EPA Gives Thumbs Up to Chlorpyrifos

EPA announced a proposed interim decision in December, 2020 on the highly neurotoxic pesticide chlorpyrifos, functionally continuing its registration for many agricultural uses which remained after EPA negotiated a phase out of most uses in 2000. *(See full story on p.35.)* The interim decision ignores the serious neurotoxic effects to young children, most concerningly brain function, as well as to farmworkers, critical species and ecosystems, and the public generally.

Glyphosate Banned in Mexico

The Mexican government announced in June that it will begin a four-year phase out of glyphosate/Roundup importation and use. This comes several months after EPA reapproved the herbicide's use. The announcement means that Mexico will join other countries, such as Luxembourg, Vietnam, and Germany, in prohibiting the chemical and the toxic consumer products, like Roundup. International watchdogs are keeping an eye on reactions from the U.S., which in recent years has worked to intervene in other countries' decision-making on toxic pesticides. The government's announcement cites the Precautionary Principle as the basis, in part, for its decision. According to the Wingspread Statement on the Precautionary Principle, "Where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically." In the case of glyphosate, there is strong evidence, per a 2015 review by the International Agency for Research on Cancer (IARC), that glyphosate is carcinogenic. Since 2015, several more publications have added weight to IARC's cancer finding on glyphosate. A February 2018 meta-analysis finds "a compelling link between exposures to GBH [glyphosate-based herbicides] and increased risk of NHL [non-Hodgkin lymphoma].

Endocrine Disrupting Atrazine Reapproved

Use of the highly hazardous, endocrine disrupting weed killer atrazine is likely to expand following a decision made by EPA in September. With a claim of "regulatory certainty," the agency is reapproving use of this notorious herbicide, as well as its cousins simazine and propazine in the triazine family of chemicals, with fewer safeguards for public health, particularly young children.

Triazines are well-known to interfere with the body's endocrine, or hormonal, system. Disruptions within this delicately balanced mechanism in the body can result in a range of adverse health effects, including cancer, reproductive dysfunction, and developmental harm. These weed killers interfere with the pituitary gland's release of luteinizing hormones, which regulate the function of female ovaries and male gonads. In comments written by Beyond Pesticides to EPA, the organization notes, "Of the numerous adverse effects associated with this disruption, the two that appear to be the most sensitive and occur after the shortest duration (4 days) of exposure are the disruption of the ovarian cycles and the delays in puberty onset."

As EPA's November draft Biological Evaluation shows, wildlife is particularly hard hit by exposure to endocrine-disrupting atrazine. The chemical was found likely to harm 1,013 endangered or threatened species—56% of all

species listed under the *Endangered Species Act*. Specific studies have found atrazine exposure to result in "chemical castration" of certain frog species. It was recently found to harm the reproductive health of marsupials. Stranded dolphins and whales along the U.S. Eastern Seaboard have recently tested positive for atrazine. Despite the risk the herbicide poses to aquatic species, the Trump EPA this year waived requirements that atrazine manufacturer Syngenta-ChemChina monitor U.S. waterways for presence of the chemical.

In a press release announcing the decision, EPA Administrator Andrew Wheeler, at the time, was joined by representatives from the Missouri Farm Bureau and the head of the Triazine Network, a chemical industry group dedicated to defending these toxic herbicides. "The benefits of atrazine in agriculture are high, so these new protections give our nation's farmers more clarity and certainty concerning proper use," Administrator Wheeler said.

Beyond Pesticides joined health and environmental groups suing EPA in November over its decision to reapprove atrazine with fewer protections for children's health. Despite the chemical being banned across much of the world, EPA continues to make decisions that benefit chemical industry executives. "EPA's failure to remove atrazine represents a dramatic failure of a federal agency charged with safeguarding the health of people, wildlife, and the environment," said Jay Feldman, executive director of Beyond Pesticides. "We seek to uphold the agency's duty to act on the science, in the face of viable alternatives to this highly toxic weed killer."

Bringing Back Aldicarb?

EPA in January announced that it is reapproving the toxic, widely banned insecticide aldicarb for use on citrus fruits in Texas and Florida. Aldicarb is a highly toxic, systemic carbamate insecticide that was first manufactured in 1965. The chemical is a fast-acting neurotoxicant that binds to the active

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site of the essential enzyme for normal nerve impulse transmission, acetylcholinesterase (AChE), and deactivates the enzyme. In doing this, the chemical causes damage to the central and peripheral nervous systems, interrupting neurological activity. Aldicarb is subject to the Rotterdam Convention, an international treaty established to stop global trade of hazardous chemicals, with over 100 countries banning its use. Both EPA and the World Health Organization (WHO) classify the chemical in the highest toxicity category. However, the U.S. is one of only a few countries around the world that does not regulate aldicarb via the treaty, but had previously cancelled.

Aldicarb was among the first pesticides to be recognized to leach and contaminate pristine groundwater, first in the Central Sand region of Wisconsin and then on Long Island, New York, during the early 1980s. The chemical persists in groundwater for decades due to its long half-life between 200 to 2000 days and ingestion of aldicarb-contaminated groundwater by residents adversely affects immune system function. Furthermore, aldicarb is a systemic pesticide that plant roots and leaves readily uptake, leading to toxic chemical residues in pollen and guttation droplets easily accessible to vulnerable pollinators, like bees. In 2010, BayerCrop Science negotiated an agreement with EPA to cancel the production of Temik 15G, the sole aldicarb pesticide on the market, ending distribution by 2017.

Federal Court Blocks EPA from Weakening Farmworker Protections

Application Exclusion Zones (AEZs) are buffer zones that restrict worker entry during and after a pesticide application, with the intent of limiting dangerous exposure. EPA issued final rules in October weaking AEZ restrictions. The agrichemical Industry began pushing rollbacks to farmworker protections early in the Trump administration, starting with the 2017 announcement under former EPA Administrator Scott Pruitt that EPA would revise its Worker Protection Standards that were updated under the Obama Administration.

The agency is: i) removing responsibility for chemical-intensive farms to keep bystanders out of off-site spray areas; ii) allowing pesticide applications to stop and start when individuals enter and exit AEZs (rather than establish set safety requirements); iii) exempting on-farm families from AEZ protections, allowing dangerous pesticide applications to take place near buildings and other shelters where family members reside within an AEZ ("rather than compelling them to leave even when they feel safe remaining inside," the agency notes in a disturbingly unscientific fashion), and; iv) "simplifies" or weakens criteria for determining the appropriate buffer size for an AEZ. The rule was blocked by a temporary restraining order in December by U.S. District Court for the Southern District of New York after the agency was sued by farmworker groups.

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Scientific Studies Raise the Alarm on Pesticide Dangers

28 Pesticides Linked to Mammary Gland Cancer

Research out of the Silent Spring Institute identifies 28 registered pesticides linked with development of mammary gland tumors in animal studies. The authors, Bethsaida Cardona and Ruthann Rudel, focus on endocrine disruption as the common mechanism of the compounds. The research results, published in the journal *Molecular and Cellular Endocrinology*, supports the criticism that EPA's registration process is substantially inadequate to protect human health. Of the 28 pesticides the research identified as causing mammary tumors, EPA has only identified nine. In their study, "US EPA's regulatory pesticide evaluations need clearer guidelines for considering mammary gland tumors and other mammary gland effects," Mss. Cardona and Rudel, conclude, "It has been previously reported that chemically induced effects on the mammary gland are not assessed in the types of guideline toxicology studies required for pesticide registration, and that when mammary tumors are observed in two-year rodent cancer bioassays they are often dismissed and not carried forward into risk assessments. Some of these decisions may reflect limited appreciation for the interaction of endocrine pathways in breast carcinogenesis."

Household Pesticide Use Linked to Depression

Residential exposure to household pesticide products increases the risk of developing symptoms associated with depression, according to a study published in *Environmental Research* by researchers at the Medical College of Georgia—Augusta University, School of Medicine—Jinan University, and Guangzhou Center for Disease Control and Prevention (CDC), China. Research on pesticide-induced diseases commonly investigates pesticide exposure concerning the development of various physical illnesses, and previous studies show there are occupational risks of developing depression, especially in agriculture.

Researchers used data from 2005–2014 National Health and Nutrition Examination Surveys (NHANES), statistically designed to represent the general U.S. population, to assess the association between pesticide exposure and mental illness. The study findings establish a one-and-a-half times higher incidence of depression symptoms for those exposed to household pesticides.

For over two decades, research concerning pesticide exposure and psychiatric disorders, like depression, focused on occupational hazards, especially for agricultural farmworkers. Exposure to agricultural pesticides puts farmers at six times greater risk of exhibiting depressive symptoms, including chronic anxiety, irritability, restlessness, and sadness, according to a 2002 study, "Pesticide Poisoning and Depressive Symptoms Among Farm Residents" (*Annals of Epidemiology*). Specifically, exposure to organochlorines and fumigants (gaseous pesticides) heighten an individual's risk of depression by 90% and 80%, respectively.

Pesticide Use Linked to Lung Cancer

Chronic pesticide use, and subsequent exposure, elevate a person's risk of developing lung cancer, according to a study published in *F1000Research* by researchers at the Nakhon Sawan Provincial Public Health Office and Naresuan University, Thailand. This case control study, "Pesticide exposure and lung cancer risk: A case-control study in Nakhon Sawan, Thailand," finds a three to 12.5 times elevated lung cancer risk from exposure to herbicides, insecticides, and fungicides, controlling for age, sex, cigarette smoking, occupation, cooking fumes, and exposure to air pollution. The study compares lifetime exposure of 233 lung cancer cases, and 447 healthy neighbors matched for sex and age.

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There is a body of science linking pesticide exposure to lung cancer. A 2004 study, "Pesticides and Lung Cancer Risk in the Agricultural Health Study Cohort" (*American Journal of Epidemiology*), demonstrates a positive association between lung cancer and seven widely used agricultural pesticides (e.g., dicamba, metolachlor, pendimethalin, carbofuran, chlorpyrifos, diazinon, and dieldrin). A 1994 study, "Cohort mortality and nested case-control study of lung cancer among structural pest control workers in Florida" (*Cancer Causes Control*), finds that the risk of developing lung cancer increases with the number of years working as a pesticide applicator.

Common Pesticide Exposure Linked to Brain Effects in Fetal Development

Research has found that that agricultural and household exposures to pesticides increases the risk of a relatively rare fetal disorder called holoprosencephaly (HPE), in which the embryo's forebrain fails to develop into two distinct hemispheres. The study, "Prenatal exposure to pesticides and risk for holoprosencephaly: a case-control study" (*Environmental Health*), published in June, finds that pre-conception and the first few weeks of pregnancy is the most vulnerable period for the onset of the illness.

The study, conducted from 2016 through 2019 and led by Yonit Addissie (a MD/PhD student) and others at the National Institutes of Health and the University of Wisconsin–Madison, is a case-control study—one that compares subjects who have a disease or disorder with "controls" who do not have the disorder, comparing the frequency of exposure to a particular risk factor in each group to determine the incidence relationship between the risk factor and the disease. The 91 subjects for the study were found through the National Human Genome Research Institute's ongoing research projects on HPE.

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The 56 "controls" are children with Williams-Beuren syndrome, a genetically caused disorder unrelated to HPE, but which is also characterized by congenital malformations (e.g., by pre- and post-natal growth delays, short stature, varying degrees of mental deficiency, and distinctive facial features). Subjects in both groups were predominantly from the U.S. HPE is the most common malformation of the forebrain in humans, occurring in one of 8,000 live births. The prognosis and lifespan of fetuses with HPE vary significantly, and depend to great extent on the severity of the abnormalities.

Respiratory System Threatened by Pesticides, Elevating Vulnerability to COVID-19

A review of scientific literature on the correlation between respiratory diseases and pesticides exposure—published in August in the journal *Annals of Agricultural and Environmental Medicine* (AAEM), "Influence of pesticides on respiratory pathology—a literature review"—finds that exposure to pesticides increases the incidence of respiratory pathologies (i.e., asthma, lung cancer, and chronic obstructive pulmonary disease [COPD]—or chronic bronchitis). The review by researchers at the Iuliu Hatieganu' University of Medicine and Pharmacy Cluj-Napoca, Cluj-Napoca, Romania, looks at how pesticide exposure adversely propagates and reinforces respiratory diseases in humans. This review highlights the significance of evaluating how pesticide exposure impacts respiratory function, especially since contact with pesticides can happen at any point in the production, transportation, preparation, or application/treatment process. Study researchers note, "Knowing and recognizing these respiratory health problems of farmers and their families, and also of [pesticide] manipulators/retailers, are essential for early diagnosis, appropriate treatment, and preventive measures." These study results are critically important at a time when exposure to respiratory toxicants increases vulnerability to Covid-19, which attacks the respiratory system, among other organ systems.

The respiratory system is essential to human survival, regulating gas exchange (oxygen-carbon dioxide) in the body to balance acid and base tissue cells for normal function. However, damage to the respiratory system can cause a plethora of issues—from asthma and bronchitis to oxidative stress that triggers the development of extra-respiratory manifestations like rheumatoid arthritis and cardiovascular disease. Therefore, the rise in respiratory illnesses over the last three decades is highly concerning, especially as research fails to identify an exact cause for the increase in respiratory disease cases.

Pesticide Effects on Ecosystems Stress the Foundation of LIfe

Glyphosate Weed Killer Threatens Nearly All Endangered Species

EPA in December released a draft biological evaluation (BE) of glyphosate, finding that the use of this ubiquitous weed killer likely threatens nearly every animal and plant species on the U.S. list of threatened and endangered species —93% of them. Glyphosate is the active ingredient in many herbicides, including Roundup, Monsanto's (now Bayer's) ubiquitous and widely used weed killer; it is very commonly used with genetically modified companion seeds for a variety of staple crops, as well as for weed control on managed landscapes. These seeds are genetically engineered to be glyphosate-tolerant. Glyphosate-based herbicides are the most widely used pesticides worldwide, and deliver human, biotic, and ecosystem harms.

The regulatory context for this biological evaluation is this: EPA is legally bound to review each registered pesticide every 15 years to see whether it continues to meet the FIFRA *(Federal Insecticide, Fungicide, and Rodenticide Act*) standard for registration. The re-registration review of glyphosate has been underway since 2009. During these 11 years, the herbicide has been the subject of massive public, advocacy, and regulator attention, much of it subsequent to both the 2015 declaration by the International Agency for Research on Cancer (IARC) that the compound is a likely human carcinogen, and several successful high-profile lawsuits against Monsanto that found the chemical to cause non-Hodgkin lymphoma.

EPA has issued proposed interim decisions on glyphosate's reregistration that have allowed these herbicides to remain on the market. In May 2019, the agency declared, ignoring broad scientific consensus, that glyphosate is "not likely to be carcinogenic to humans." In January 2020, EPA issued a favorable interim review decision on reregistration, stating, "After a thorough review of the best available science, as required under the *Federal Insecticide, Fungicide, and Rodenticide Act*, EPA has concluded that there are no risks of concern to human health when glyphosate is used according to the label." Some ask, where's the science?

Beyond Pesticides and other public health, conservation, and farmworker advocacy organizations brought suit against EPA in March 2020 for that interim approval. The plaintiffs charge EPA with bias, ignoring and using incomplete scientific data, and delay in finishing "any assessment of [glyphosate's] impacts on thousands of potentially harmed endangered species, delaying it until a future decision." Represented by the Center for Food Safety (CFS), plaintiffs, including the Rural Coalition, Farmworker Association of Florida, Organización en California de Lideres Campesinas, and Beyond Pesticides, filed the federal lawsuit in the Ninth Circuit Court of Appeals. The groups seek to have the pesticide prohibited from use or sale because of its unlawful approval.

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EPA Underestimates Contamination of Waterways with Insecticide

The insecticide fipronil is more toxic to aquatic insects than previously thought, often present in U.S. waterways, and can trigger trophic cascades that disrupt entire aquatic ecosystems, finds Colorado State and the U.S. Geological Survey (USGS) researchers. The research, "Common insecticide disrupts aquatic communities: A mesocosm-to-field ecological risk assessment of fipronil and its degradates in U.S. streams," is published by the American Association for the Advancement of Science in the October issue of *Science Advances*. The data have important implications for waterways throughout the country, but particularly in the Southeast U.S. where the chemical was found at hazardous levels in over half of sampled steams. Despite the high quality of the findings by a U.S. government agency, pesticide regulators at EPA do not adequately consider ecosystem-level effects when determining whether to register a pesticide.

According to a USGS press release, "Concentrations of fipronil compounds determined to be toxic by the new mesocosm study are 3 to 2,600 times lower than those reported in the literature, depending on the fipronil compound. . ." The release continues, "18% of the streams sampled nationally had fipronil compound concentrations, averaged over a 4-week sampling period, that exceeded the benign level determined by the mesocosm experiment. In the Southeast, where fipronil was detected more frequently than in the other four regions, 52% of streams sampled had fipronil compound concentrations that exceeded the benign level."

Fipronil has both wide residential and agricultural uses, including for the control of ants and termites and on crops

including corn, potatoes, and orchards. According to the authors, "Although fipronil has been found in high concentrations (6.41 μg/liter) in streams of some agricultural areas with high application rates, urban streams across the United States typically have more detections and greater concentrations than agricultural streams, with storm events being positively correlated with detection."

Replacements for Neonic Bee-Toxic Pesticides Just as Harmful

With neonicotinoid (neonic) insecticides coming under fire for their widespread adverse effects on a broad range of beneficial insects—including their major contributions to the decline of critical pollinators—more such "novel" pesticides are being brought to market in response, raising the same problems. So, it is important, that the September publication, "Do novel insecticides pose a threat to beneficial insects?", critiques the hazards of the replacement pesticides, flupyradifurone and sulfoxaflor. These insecticides share the same mode of action as neonics, although they are (nominally) from different chemical classes. Both Dow Agrochemicals' (now Corteva) sulfoxaflor (classified as a butanolide) and Bayer CropScience's flupyradifurone (classified as a sulfoximine) are now being considered as replacement products for pest species that resist neonics, and where neonic compounds are restricted or banned.

The research was conducted by Harry Siviter, PhD and Felicity Muth, PhD of the Department of Integrative Biology at the University of Texas at Austin; the subsequent paper was published by the *Proceedings of the Royal Society B: Biological Sciences* in September 2020. The researchers' meta-analysis extracted useful data from 19 of the 26 studies they reviewed, and paid particular attention to impacts on beneficial insects—dominantly, on bee species—and evaluated outcomes related to organism mortality, reproduction, and behavior. In addition, the scientists evaluated impacts on predator species, such as wasps, lacewings, and beetles.

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The researchers learned that flupyradifurone can have lethal impacts at field-realistic levels, with some kinds of bees being more vulnerable than others; further, and unsurprisingly, exposures to the compound were more likely to be harmful in combination with other environmental stressors, such as poor nutrition, pathogens, or other agricultural chemicals. The coauthors note that the lethality of sulfoxaflor, which is toxic to bees at high levels of exposure, may vary at lower doses, depending on the interactions with other environmental factors. But given certain combinations of those variables, sulfoxaflor exposures at field-realistic levels appear to increase bee mortality.

The study also shows that sulfoxaflor has negative impacts on bee reproduction similar to those of neonics, particularly reduced reproduction (egg laying) and poor larval development, and that flupyradifurone exposures impair bees' flight behavior, foraging success, and bodily temperature regulation. Findings include impacts on beneficial predators, including a huge increase (40–60%) in the mortality of flupyradifurone-exposed rove beetles, and 100% mortality of exposed insidious flower bugs (also known as pirate beetles).

Sulfoxaflor shows harmful effects on many taxa: hymenoptera (bees, wasps, ants), coleoptera (beetles), and hemiptera (cicadas, aphids, planthoppers, leafhoppers). At field-realistic exposure levels, for example, the parasitic activity of some wasps was reduced, and mortality increased; lacewings showed increased mortality and reduced fertility; ladybug larvae suffered 100% mortality; and pirate beetle mortality was 96% within 24 hours of exposure to sufoxaflor.

Flea Pesticides Contaminate Waterways

Many pet owners likely do not consider what is actually in the flea treatments they administer to their animals. That should change, and recent research demonstrates why. Scientists sampling rivers in England found extreme contamination with two neurotoxic pesticides commonly used in flea products for dogs and cats: fipronil and the neonicotinoid imidacloprid. In many instances, the concentrations in the waterways are far higher than accepted "safe" levels, according researchers Dave Goulson, PhD and Rosemary Perkins, PhD at the University of Sussex in the study, "Pesticides commonly used as flea treatments for pets are contaminating English rivers" (*Science News*).

Though these compounds are banned for agricultural uses in the United Kingdom (UK), risk assessment for them, as used on animals, has been minimal because of the assumption that the amounts used for veterinary treatments would result in far less significant environmental impact than might be expected with agricultural-scale use. This research challenges that assumption, and the researchers recommend "re-evaluation of the environmental risks posed by pet parasite products, and a reappraisal of the risk assessments that these products undergo prior to regulatory approval."

Court Challenge Speaks to Need for Stronger Environmental Law

Petitioners who mounted a legal challenge to the Environmental Protection Agency's (EPA) registration of Enlist Duo, a relatively new and highly toxic pesticide product combining 2,4-D and glyphosate, learned in July of a mixed decision from the U.S. Ninth Circuit Court of Appeals in the case. The good news is that Judge Ryan D. Nelson, writing the opinion for the court, found that EPA, in registering the herbicide Enlist Duo, had failed to protect monarch butterflies. On the other and disturbing hand, the court concluded that EPA registration of the product was otherwise lawful—which means that this toxic compound will for now remain on the market. Represented by Center for Food Safety and Center for Biological Diversity, the plaintiffs—Beyond Pesticides, Pesticide Action Network North America, National Family Farm Coalition, and Family Farm Defenders—are adamant that this product should not be registered for use by EPA.

In December, the Fish and Wildlife Service found that "adding the monarch butterfly to the list of threatened and endangered species is warranted but precluded by work on higher-priority listing actions." According to the agency, "With this decision, the monarch becomes a candidate for listing under the Endangered Species Act (ESA), and its status will be reviewed each year until it is no longer a candidate."

The combined herbicide, Enlist Duo, was developed to be used on genetically engineered (GE), herbicide-tolerant crops, such as corn, soybeans, and cotton—the notion being that when applied, it would knock down broadleaf weeds, but not affect the GE crops. Enlist Duo was created in response to target weeds' development of resistance to glyphosate herbicides, most notably, Monsanto's (now Bayer's) Roundup, which has been used intensively during the past two decades. Dow Chemical (now Corteva) rushed to offer Enlist Duo as a quick fix to the problem, but independent scientists and USDA analysis predict that its use will inevitably foster more weed resistance.

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Agent Orange Benefits Finally Become Law

The Vietnam War ended in 1975, but it was December 2020—45 years later—that Congress passed and the President signed the *Fair Care for Vietnam Veterans Act*, providing health care benefits and disability compensation for Agent Orange (2,4-D and 2,4,5-T) exposure. The legislation, introduced by Rep. Josh Harder (D-CA) and Senator Jon Tester (D-MT) and included in the *National Defense Authorization Act*, establishes a service connection for Parkinson's disease, bladder cancer, hypertension, and hypothyroidism resulting from the use of the herbicide to defoliate the Vietnam jungle. According to the Disabled American Veterans (DAV), 83,000 former service members suffer from these diseases. The scientific literature has linked Agent Orange to the range of adverse effects and a robust report published by the National Academy of Medicine in 2016 recommended expanding coverage.

Elevating the Pest Resistance Problem in Genetically Engineered Crops

Another example of trading health and environmental protection for the support of special interests, EPA in October announced the misleading and fraudulently named, "EPA Supports Technology to Benefit America's Farmers." This time, EPA announces plans to "streamline the regulation of certain plant-incorporated protectants (PIPs)." Named to sow confusion, PIPs are plants engineered with pesticides in them. They are known in general for

two problems arising from incorporating pesticidal ingredients into crops: residues that cannot be washed off and production of crop-eating insects that are resistant to the incorporated pesticide that blankets the agricultural landscape.

EPA is proposing to exempt from regulation certain PIPs created by biotechnological techniques that are cisgenic (using genes derived from sexually compatible species), such as CRISPR. The distinction that EPA seeks to make between cisgenic plants and transgenic plants (in which the gene of interest may come from any species) is not supported by science. In fact, cisgenic techniques make use of genetic material other than the targeted genes, and that may come from species that are not sexually compatible with the crop. The bottom line: these genetically engineered organisms introduce havoc into biological systems and the local ecology.

Two important confounding aspects that EPA ignores are the likely move by the biotech industry to use multiple genetic manipulations—EPA has never been good at assessing risks of multiple stressors—and pleiotropy. (Pleiotropy is the fact that a single gene controls more than one trait, so that introduction of a genetic change may have unanticipated impacts.)

The other important effect of the use of PIPs is the certain development of resistance in pest organisms. Resistance creates severe economic impacts on farmers and the food production system because it leads to crop failures and requests to use more toxic compounds on for so-called pest emergencies. These resistance events are predictable outcomes that should not qualify for emergency use of unregistered pesticides under a loophole in the federal pesticide law. Because PIPs present a constant exposure to the pesticide, they present a constant selection pressure for resistance. Resistance to *Bacillus thuringiensis (Bt)* arising from its incorporation as a PIP in corn has resulted in the loss of effectiveness of this biological insecticide and the use of more toxic insecticides as a replacement.

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Pollinators Under Continuing Threat

Court Upholds Fish and Wildlife Service Reversal on Environmental Protections

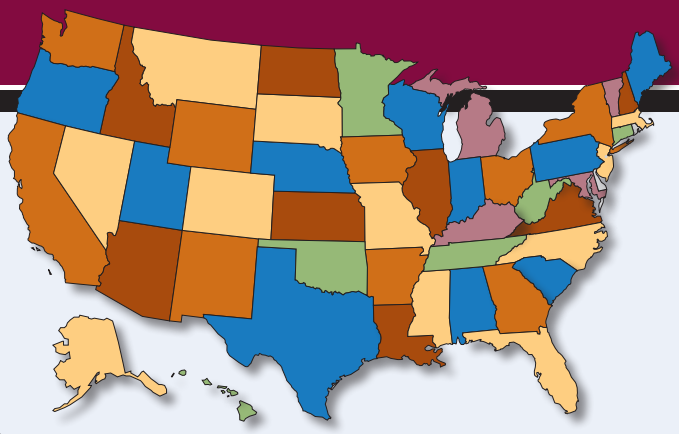
A federal judge in September dismissed an environmental lawsuit seeking to reinstate a U.S. Fish and Wildlife Service (FWS) rule, killed by the Trump Administration, which banned the use of neonicotinoid insecticides and genetically engineered (GE) crops, and adopted a precautionary approach to pest management. The decision comes on the heels of a Center for Biological Diversity (CBD) analysis that reports a 34% increase in the pesticide use on U.S. national wildlife refuge acres over a two-year period from 2016–2018.

In 2012, Beyond Pesticides and other environmental groups, led by Public Employees for Environmental Responsibility and Center for Food Safety, won a court battle to halt genetically engineered crops, and related herbicide-tolerant herbicides, on wildlife refuges in the southeast. This led to a grassroots campaign and public pressure from advocates and environmental groups, resulting in a FWS decision to adopt a national phase out of GE crops and ban neonicotinoid (neonic) insecticide use on national wildlife refuges. However, in 2018, FWS reversed the prohibition on GE crops and neonicotinoids via a memorandum that allows the refuge system to make decisions on the use of GE crops and neonics on a case-by-case basis in compliance with the *National Environmental Policy Act* (NEPA).

Pesticides Deprive Bees of Sleep, Adding to Decline

Neonicotinoid insecticides inhibit honey bee sleep cycles, leading to stress and population declines, according to the study "Neonicotinoids disrupt circadian rhythms and sleep in honey bees" out of Vanderbilt University and published in the November issue of *Scientific Reports*. Although there is already ample evidence of the dangers these systemic insecticides pose to pollinators—as evidenced by recent bans in the European Union and Canada—this new line of investigation adds further detail to the ongoing crisis in the pollinator world.

"Graphically, normal circadian rhythms look like steady waves," said Giannoni-Guzmán, PhD, the paper's co-first author. "When we observed bees that consumed neonicotinoids over several days, we saw a loss of waves, movement at random times or signs of barely any sleep at all." Disruption of the circadian clock has far-reaching implications on complex social insects like the honey bee. Many are familiar with the evidence that neonicotinoids disrupt navigation, foraging, memory, and learning in exposed bees. Circadian rhythms and sleep patterns support those critical functions. Sleep deprived honey bees are thus more likely to have difficulty returning home after foraging, and remembering or communicating through waggle dance the location of pollen and nectar.



IMPERATIVE FOR SAFER CHEMICALS

Pesticides Exacerbate COVID-19 Hazards

Responsible Response to COVID-19

There are many levels at which we confront the coronavirus with measures that prevent transmission and exposure in three areas—(i) safer disinfectants, (ii) cultural practices, equipment, and ventilation, and (iii) factors that elevate risk for contracting the virus.

Safer Disinfectants: Beyond Pesticides has provided information and a frequently updated webpage that offers information on safer disinfectants and sanitizers, given that so many on the market are hazardous materials. (See *bp-dc.org/disinfectants.*)

Cultural Practices, Equipment, and Ventilation: We have learned about social distancing, wearing face masks that block the virus without antimicrobial materials *(see "Antimicrobial Face Mask Unnecessarily Toxic" at* bp-dc.org/facemask), hand and surface washing with soap and water. Key to returning to public indoor spaces are ventilation systems for the indoor environment that filters the air. Of concern is the adoption of adequate protocol and effective ventilation equipment that enables the safe return to school buildings and other places *(see p.26,* Can Schools Be Opened Safely During the COVID-19 Pandemic?).

Factors that Elevate Risk for Contracting the Virus: It is critical in personal and institutional decision-making to understand vulnerabilities, comorbidities, disproportionate risk, and those exposures to pesticides in our daily lives that increase our risk of contracting the virus and, in fact, exacerbate potential harm. We can manage the threat of coronavirus with safer products and chemicals that do not actually increase the threat. To that end and in an effort to ensure informed and protective decision-making, the studies cited here are of concern, as we track the scientific literature on best strategies for staying safe. *(See also the new scientific data linking pesticides to respiratory illness on p.7.)*

Toxic Disinfectants Used during Pandemic Can Cause Harmful Skin Reactions

Prolonged dermal (skin) exposure to hazardous disinfectants through handling and/or residue on surfaces can induce adverse skin reactions (i.e., inflammation, burns, necrosis), according to a review analysis published in *Clinics in Dermatology.* Researchers of the review, "Dermatologic reactions to disinfectant use during the COVID-19 pandemic," examine skin reactions associated with dermal exposure to various disinfectants approved for use against COVID-19 by the European Chemical Agency (ECA) and the U.S. Environmental Protection Agency (EPA).

With the outbreak of SARS-CoV-2 (COVID-19), the global demand for disinfectants and sanitizers has increased substantially as a means of preventing illness in residential and nonresidential settings. Initially, public health officials considered disinfection highly trafficked areas as the most effective way to combat COVID-19. This notion has led to improper disinfection practices in many countries where trucks, drones, or robots disperse massive amounts of disinfectants into public areas. Furthermore, the Centers for Disease Control (CDC) has reported a sharp increase in calls to poison control centers regarding illnesses resulting from the use of toxic disinfectants during the pandemic. The World Health Organization (WHO) and other infectious disease specialists condemn indiscriminate and vast amounts of disinfectant spraying in public areas, as it is both ineffective and a health hazard on contact or when combined with other disinfectants.

The review includes ten different chemical classes: alcohols (i.e., isopropanol, ethanol), biguanides (i.e.,

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polyhexanide), α-hydroxy acids (AHA) (i.e., citric acid, lactic acid, glycolic acid), chlorine and chlorine compounds (i.e., sodium hypochlorite/bleach, sodium chloride), metal ions (i.e., silver, nano-silver), aldehydes (i.e., glutaraldehyde), peroxygen compounds (i.e., hydrogen peroxide, peroxyacetic acid), iodophors (i.e., containing iodine and a surfactant/wetting agent), phenolic compounds (i.e., cresols, hexachlorobenzene, chlorophenols), anionic surfactants (i.e., dodecylbenzene sulfonic acid), and cationic surfactants (i.e., quaternary ammonium compounds).

According to the findings, most disinfectants cause some form of acute skin irritation. Although certain disinfectants are less harmful upon dermal contact than others, many of these chemicals cause irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD). ICD is a nonimmune response that manifests into a localized skin inflammation by directly damaging the skin following toxic agent exposure. ACD is an immune response to skin contact with a dermal allergen to which an individual is already allergic or sensitized, causing non-localized skin inflammation and/or systemic bodily response. However, chronic, cumulative exposure to more mild chemical irritants can still elicit a skin reaction.

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Antioxidant Deficiency, Induced by Pesticide Exposure, Linked to Deadly COVID-19 Cases

Research at the University of Wisconsin–Madison (UWM) suggests that fludioxonil—a commonly used agricultural fungicide—decreases the human body's ability to defend itself against illnesses, like COVID-19, and promotes disease permanency. Tristan Brandhorst, PhD, a scientist at UWM, notes that a pesticide-induced reduction in the antioxidant glutathione, produced in the liver (covered in "Highly Destructive Pesticide Effects Unregulated," Spring 2020, *Pesticides and You*), could be responsible for this lack of bodily defense against disease. Although many studies examine how pesticides adversely affect the human body (i.e., cancer, respiratory issues, etc.), very few studies assess how pesticides reinforce chemical disruption patterns that reduce levels of vital chemicals needed for normal bodily function. The steady rise in U.S. pesticide use, including disinfectants, threatens animals and humans, as exposure to indiscriminate dispersal of pesticides cause a whirlwind of health risks. Dr. Brandhorst stresses the need for proper reevaluation of pesticide risks, stating, "The issue needs more study [and] might also warrant a reworking of how [EPA] evaluates pesticides."

Professor Alexey Polonikov, MD, PhD, director of the Research Institute for Genetic and Molecular Epidemiology, Kursk State Medical University in Kursk, Russia—"Endogenous deficiency of glutathione as the most likely cause of serious manifestations and death in patients with the novel coronavirus infection (COVID-19): a hypothesis based on literature data and own observations"—shares his experiential and research data, which appears to intersect with Dr. Brandhorst's findings: "Based on an exhaustive literature analysis and [my] own observations, I proposed a hypothesis that glutathione deficiency is exactly the most plausible explanation for serious manifestation and death in COVID-19 infected patients. The major risk factors established for severe COVID-19 infection and relative glutathione deficiency found in COVID-19 infected patients with moderate-to-severe illness have converged me to two very important conclusions: (1) oxidative stress contributes to hyper-inflammation of the lung leading to adverse disease outcomes, such as acute respiratory distress syndrome, multiorgan failure and death; (2) poor antioxidant defense, due to endogenous glutathione deficiency as a result of decreased biosynthesis and/or increased depletion of GSH [glutathione], is the most probable cause of increased oxidative damage of the lung, regardless which of the factors (aging, chronic disease comorbidity, smoking or some others) were responsible for this deficit."

Communities Ban Biosolid Fertilizer Use, Questioning COVID-19 Contamination

Communities across the U.S. are restricting the use of biosolids (sewage sludge) in their jurisdictions, as researchers at Michigan Tech plan to study whether COVID-19 can persist in wastewater

and sewage sludge. While relatively unknown to many city-dwellers, the use of recycled human waste on farm fields is a common practice in many rural communities throughout the country. Issues associated with smell, runoff, and contamination are often the impetus for local leaders to investigate and consider banning their spread, but the potential for the waste to vector coronavirus gives the issue a new sense of urgency.

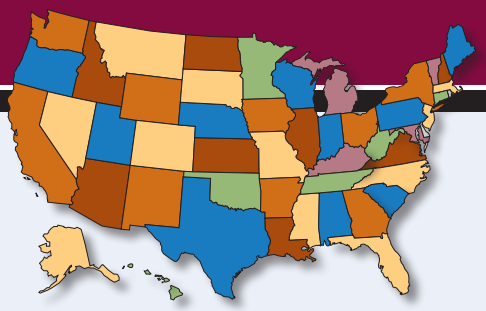
In Oklahoma, the small town of Luther voted to ban the use of biosolids on farmland in June. Local leaders looked into the safety of biosolid use, and found concerning information, including a report from the U.S. Environmental Protection Agency's Office of Inspector General, which identified over 350 pollutants in biosolids, 61 of which are considered hazardous. "The more research I did, the more I realized this is something we really need to fight and we have to all come together," said local resident and farmer Saundra Traywick to reporters. "The EPA only requires testing for nine to 12 contaminants. There's 250 contaminants that aren't being tested for."

Local leaders in Indian River County, FL have also taken action against sewage sludge use in their community. After first banning use in 2018 due to concerns over runoff into Blue Cyprus Lake causing toxic algae blooms, *TCPalm* reports that the county approved a six-month extension on the moratorium. Some county commissioners are calling on the community to make the ban permanent.

EPA Allows American Airlines to Use Unregistered Disinfectant under Emergency Authority

EPA in August granted "emergency" permission to the State of Texas to allow the use of SurfaceWise®2, an unregistered pesticide, as an antiviral surface coating. The manufacturer, Allied Bioscience, says the compound can kill coronaviruses (including SARS-CoV-2) starting at two hours post application and for up to seven days, but it is not included on EPA's List N of disinfectants effective against SARS-CoV-2. EPA has permitted this use via the authority of Section 18 of the *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA), which allows for "emergency" use of unregistered pesticides, typically to deal with extreme threats to agricultural activities. It is rarely used for public health emergencies. Beyond Pesticides recognizes the need for protection from transmission of the novel coronavirus, and maintains that it ought to and can be done without exposing people to toxic synthetic pesticides that have not undergone evaluation for safety.

The Texas Department of Agriculture secured the EPA exemption, making the state the first to do so; Allied BioScience is pursuing this emergency waiver across all 50 states. The exemption grants American Airlines and two health care facilities in the state the ability to use the unregistered pesticide, which is applied by electrostatic spraying. Usually, a Section 18 exemption would be made absent other viable alternatives to address the problem and when there are at least minimal health and environmental safety data available for the compound; neither is the case for SurfaceWise®2.



Allied BioScience touts the compound as "non-toxic, non-irritating, odorless and contain[ing] no chemicals that produce harmful vapors or gases." Yet, on EPA's List N are a legion of products with active ingredients known as quaternary ammonium compounds or "quats," about which there are toxicity concerns. In fact, roughly half of the List N products contain a quat as the single active ingredient. An active ingredient in SurfaceWise®2 is a quaternary ammonium.

Quats have been linked to a range of human health harms, including increased risks of asthma and allergic response; mutagenicity (e.g., some quats have been shown to damage DNA in human lymphocytes at much lower levels than are present in cleaning chemicals); contact dermatitis and other skin irritation; lowered fertility; and potential and significant disruption of key cellular processes. The National Institutes of Health designates quaternary ammonium as "asthma-causing and irritable to eyes and skin, flammable and corrosive, harmful to aquatic ecosystems, and persistent in the environment." There are also concerns about quats' ability to catalyze antibiotic resistance, and impacts on the human respiratory system—of particular concern in the era of COVID-19, which in many people damages lung tissue and compromises oxygen delivery to the body's cells. The use of quats, which have been on the market since the early 20th century (before EPA began regulating potentially harmful chemicals) should be less facile—particularly during a massive public health pandemic. *(See p.30 for fact-sheet on quaternary compounds.)*

Urban Wildlife Threatened from Toxic Coronavirus Disinfectant Use

An alarming new scientific report finds that excessive, indiscriminate toxic disinfectant use against COVID-19 puts wildlife health at risk, especially in urban settings. The analysis, "Massive use of disinfectants against COVID-19 poses potential risks to urban wildlife," published in the journal *Environmental Research*, finds many of the chemical ingredients in disinfectant products are "acutely toxic to both terrestrial and aquatic animals," causing death following exposure.

Additionally, these chemicals have implications for human health, as infectious disease specialists at the World Health Organization (WHO) warn that excessive disinfectant use can cause respiratory problems, especially for those with underlying respiratory conditions. With the total U.S. COVID-19 cases rising, lack of proper disinfection guidelines and monitoring generates concerns surrounding heightened environmental pollution. The authors' analysis supports the need for global leaders to regulate the spraying of disinfectants. The authors note, "The overuse of disinfectants may contaminate the habitats of urban wildlife.…Therefore, it is important that disinfectants used to control COVID-19 in urban environments are selected and applied in ways that avoid unnecessary environmental pollution."

At least 135 animals of 17 different species (including wild boars, weasels, common blackbirds [*Turdus merula*], and other bird species) died after disinfectant exposure from spraying, according to the report. Chemical disinfectants can irritate and destroy the mucous membranes in animal and human respiratory and digestive tracts upon ingestion or inhalation.

Science Supporting Urgent Action to Eliminate Toxics in Land Management

From Environmental Degradation to the Climate Crisis

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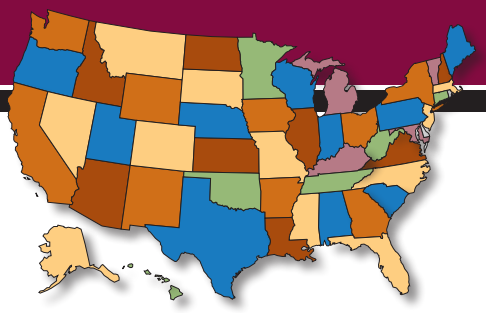
As Beyond Pesticides continues to advance land management practices, both cultural methods and products compatible with ecosystem health, the scientific literature informs our understanding of the urgency of the climate crisis and the importance of eliminating hazards that contribute to it. With this in mind, the articles cited here offer critical support to informing sound public policy and practices at the local, state, and federal level that embrace strong organic standards.

Eliminating Pesticides and Fertilizers Critical to Confronting Climate Crisis

Eliminating nitrogen fertilizers is a keystone element to mitigating the impending climate catastrophe, as research shows that agriculture is driving global nitrous oxide (N_2O) emissions higher than any projected scenario. According to the latest research, "A comprehensive quantification of global nitrous oxide sources and sinks," published by an international team of scientists in the journal *Nature,* failure to adequately address nitrous oxide emissions has the potential to impede the ability for the world to keep warming below the 2°C target established under the Paris Climate Agreement, necessitating further cuts in other greenhouse gasses. The paper is a clarion call for greater attention to agriculture's role in generating and mitigating the climate crisis.

Nitrous oxide both damages ozone and warms the atmosphere, as it is roughly 300x better at capturing heat than carbon dioxide. To account for global nitrous oxide emissions, the research team synthesized emission data from a wide range of both anthropogenic and natural sources, including consideration of the biogeochemical processes that influence N_2O release



into the atmosphere. In sum, it covers 21 natural and human related sectors between the years 1980 and 2016.

Growth in nitrous oxide emissions over these last four decades has been considerable, with human-caused release, mostly from fertilizer use on cropland, increasing by 30%.

Synthetic nitrogen applied to cropland can also be emitted from agricultural soil in the form of harmful nitrogen oxides (NO_x, NO, NO_2). In this form, nitrogen compounds not only damage the ozone layer and contribute to climate change, but also lead to the creation of smog and acid rain, increasing public health risks for asthma and other respiratory illnesses. A 2018 study, "Agriculture is a major source of NO_x pollution in California" (*Science Advances*), determined that the state of California is woefully underestimating nitrogen oxide emissions from agricultural sources.

In addition to reducing the influx of dangerous nitrogen compounds into the atmosphere, organic land management systems, on both farms and nonagricultural landscapes, sequester significant amounts of carbon from the atmosphere into on-site soil carbon. A report from the Rodale Institute, *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming*, expounds on these benefits. It reads, "Simply put, recent data from farming systems and pasture trials around the globe show that we could sequester more than 100% of current annual CO_2 emissions with a switch to widely available and inexpensive organic management practices, which we term 'regenerative organic agriculture.' These practices work to maximize carbon fixation while minimizing the loss of that carbon once returned to the soil, reversing the greenhouse effect."

Sulfur Emissions from Pesticides and Fertilizers Damage Ecosystems

Synthetic pesticides and fertilizers supersede fossil fuels as the greatest contributor of sulfur emissions in the environment, according to a study published in August, "A shift in sulfur-cycle manipulation from atmospheric emissions to agricultural additions," a National Science Foundation (NSF)-funded study, published in *Nature Geoscience*. Particularly, atmospheric sulfur dioxide and reactive sulfur emissions contribute to sulfur deposition through acidic rain and snow, causing a multitude of human and animal of health problems and environmental degradation. Although some U.S. policy regulations curb sulfur emissions from atmospheric sources, alternative sulfur inputs from agricultural sources can cause similar issues as atmospheric sulfur emissions, including acid rain.

With peak sulfur concentrations from agricultural outputs up to ten-fold higher than previous 20th-century sulfur levels, studies like these are significant in understanding how underrepresented pollution sources may contribute to overall environmental pollution. Philip C. Bennett, PhD, program director in NSF's Division of Earth Sciences, research results "…illustrate the intertwined nature of natural and human-driven biogeochemical cycles, and reveals new implications of sulfur in

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our environment, including effects on nutrient availability and runoff, food production and toxic metals."

Climate Crisis Brings the Release of Toxic Pesticides from Glacier Melt

Persistent organic pollutants (POPs), including banned and current-use pesticides are present in snow and ice on top of Arctic glaciers, according to the study, "Atmospheric Deposition of Organochlorine Pesticides and Industrial Compounds to Seasonal Surface Snow at Four Glacier Sites on Svalbard, 2013–2014," published in *Environmental Science & Technology*.

Past research finds that air contaminated with these environmentally bioaccumulative, toxic chemicals drift toward the poles, becoming entrapped in ice under the accumulating snowfall. As the global climate continues to rise and the climate crisis worsens, studies like this become significant, as glaciers encapsulating these toxic chemicals are melting. Upon melting, some chemicals can volatize back into the atmosphere releasing toxicants into air and aquatic systems, with the ensuing consequences.

As global warming progresses and the melting glaciers release more POPs into waterways, exposure concerns will increase significantly, especially for children who are more vulnerable to toxic effects of chemical exposure. To mitigate the risks associated with chemical exposure from toxic pesticides, advocates say that the manufacturing and use of pesticides must be addressed first and foremost. If pesticide use and manufacturing are amplifying the impacts of the climate crisis, advocates argue that it is essential to incite change at the point source through statutes and regulation that eliminate use.

This study quantifies POPs accumulation deposited on Arctic snow over one winter using four glaciers of various altitudes (Holtedahlfonna, Kongsvegen, Lomonosovfonna, and Austfonna) across Svalbard (a Norwegian archipelago). While the presence of POPs in Arctic air is well-known, much less is understood about atmospheric deposition. To identify what chemicals are present, researchers collected and analyzed 12 snow samples from each glacier site, surveying for 36 pesticides and seven industrial chemicals with Gas Chromatography-Mass Spectrometry (GC–high-resolution MS).

All seven industrial chemicals and 13 pesticides are detectable at all glacier sampling sites, with the total fluctuation of pesticide concentrations greater than industrial chemicals at all sites, according to the study. The seven industrial chemicals include hexachlorobutadiene, 1,2,3,4-tetrachlorobenzene, 1,2,4,5-T4CB, pentachlorobenzene, pentachloroanisole, 3,4,5,6-tetrachlorodimethoxybenene, and hexachlorobenzene. The 13 pesticides include heptachlor, heptachlor epoxide B, aldrin, α-and γ-hexachlorocyclo-hexane (HCH), chlorpyrifos, *trans*- and *cis*-chlordane, 4,4'-DDE, dieldrin, dacthal (DCPA), *trans*-nonachlor, and α-endosulfan Chlorpyrifos, dieldrin, and *trans*-chlordane dominate most Arctic areas, accounting for at least 50% of the total pesticide concentrations at each sample site.

Rising Water Temperature and Pesticide Exposure Harm Coral Reef Fish

Climate change and pesticide pollution are known to put coral reef fish at significant risk, but research, "Anthropogenic stressors impact fish sensory development and survival via thyroid disruption," published in *Nature Communications* in July, shows how these risks can be both overlapping and synergistic. "Fish face a variety of human-induced stressors including increasing water temperatures and pollution from agricultural pesticides," says study coauthor William Feeney, PhD at Griffith University (AUS). According to researchers, both of these stressors alone harm the endocrine (hormone) system and are subsequently

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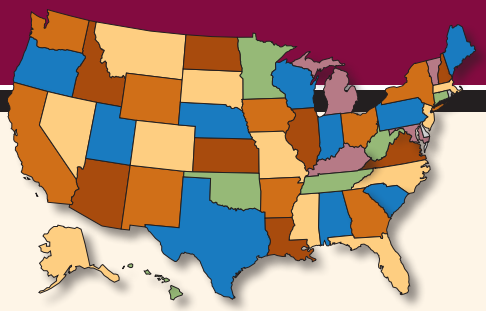
exacerbated in combination with each other. To study the impact of climate change and pesticide pollution, researchers exposed confined surgeonfish (*Acanthurus triostegus*) to varying levels of water temperature increases, as well as varying levels of the insecticide chlorpyrifos. The scientists then observed how these changes affected the level of hormones the fish were expressing, and how they acted in the presence of predators.

"Both a three-degree temperature increase and exposure to pesticide led to a decrease in the amount of thyroid hormones in exposed fish," said Marc Besson, PhD, lead author, from PSL Research University, Paris. "These hormones control the development of sensory structures such as the retina, the nostrils and the lateral line, which enables fish to detect nearby water movement."

When exposed to stressors during metamorphosis from an egg into a juvenile fish, this can significantly impact a fish's success in the wild. "This matters because animals use their sensory systems to inform ecologically important behaviours, such as their ability to identify and respond to predators," said Dr. Feeney. By failing to consider the environment holistically, we create large blind spots that limit our ability to enact comprehensive change that truly improves ecosystem health.



Local and State Action Leads the Nation

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Local and state action is critical to change and typically leads the way on critical issues of environmental and public health protection. Local decision-makers, elected officials, and community residents express a keen awareness of the urgent need to protect community health, the local ecosystem, and the global environment. With consideration of the science, local municipalities across the country are adopting organic management on farms, playing fields, and rights-of-way, and in parks, schoolyards, and backyards. In so doing, local communities are leading the nation in protecting public health, and playing an instrumental role in addressing the devastating decline in biodiversity, while confronting the climate crisis by eliminating petroleum-based pesticides and synthetic fertilizers and nurturing soil systems that sequester atmospheric carbon.

South Portland, ME Bans Synthetic Fertilizers in Its Jurisdiction

In expanding its land management ordinance in November, the South Portland, ME City Council amended its pesticide ban ordinance with a provision that eliminates synthetic fertilizers. The language draws on allowed materials under USDA's organic program's *National List of Allowed and Prohibited Substances*, limiting fertility to organic compatible soil amendments, except in the case of waivers. If the managers of "performance turf" (grounds used for athletic fields or golf courses) or new developments (municipal authority to restrict pesticides in Maine is not preempted by state law) would like to seek a waiver from a community panel (Land Management Advisory Committee), they must show that it has carried out an organic systems management plan which identifies the soil testing results, cultural practices schedule (aeration, overseeding, mowing height, etc.), fertility practices and, schedule, and other inputs (e.g. pesticides, soil supplements) and schedule of application.

Philadelphia, PA Passes Herbicide Ban that Encourages Transition to Organic

The Philadelphia City Council in December passed Bill #200425, known as *Healthy Outdoor Public Spaces* (HOPS), a sweeping ban of herbicides (weed killers) on its public property that stops short of banning all toxic pesticides, while encouraging the adoption of organic land management. With wide support for broad pesticide restrictions from public health and labor groups, scientists, and land managers, the bill was adopted by a unanimous vote. The effort was spearheaded by Toxic Free Philly, a group of local residents deeply concerned about the impacts of pesticides on health and the environment. While the hearing record and the bill's language indicates a clear spirit and intent to move Philadelphia's public spaces to organic practices, advocates cite the importance of public involvement and oversight to ensure their goals are achieved.

California Legislature Votes to Ban Highly Hazardous Rodenticides

The California legislature in August voted to ban, with limited exceptions, the use of highly toxic rat poisons. The *California Ecosystems Protection Act of 2020,* AB 1788, was passed after over a year of advocacy by groups and individuals concerned about the impact of second-generation anticoagulant rodenticides (SGAR) on state and local wildlife. Proponents of the legislation are advocating that lawmakers in other states follow California's lead by passing similar legislation. Governor Gavin Newsom signed the bill into law on September 29, 2020.

Science Comments Submitted to Keep Toxic Herbicides Out of Lake Tahoe

Beyond Pesticides joined with the Toiyabe Chapter of the Sierra Club to urge that

alternatives to herbicides be the chosen approach for managing Lake Tahoe, urging that no herbicides be used to manage vegetation in this treasured and sacred ecosystem. The Tahoe Regional Planning Agency and Lahontan Regional Water Quality Control Board (TRPA/LRWQCB) accepted comments on a draft environmental impact report/environmental impact statement (EIR/EIS) analyzing environmental impacts of a proposed Tahoe Keys Lagoons Aquatic Weed Control Methods Test. The groups urged the authorities to adopt Action Alternative 1: Testing of Non-Herbicidal Methods Only is the environmentally best choice and should be selected for the proposed weed control test program. The comments are being reviewed.

Massachusetts Enacts New Measures for Mosquito Management with Pros and Cons

Massachusetts lawmakers finalized in July, and the Governor subsequently signed, emergency legislation, aimed at revamping the state's approach to mosquito management. The final version of this mosquito reform bill continues to include certain problematic provisions, but nonetheless represents a significant shift from an initial proposal, proposed by Governor Charlie Baker (R), that would have allowed the blanket spraying of mosquito adulticides throughout the Commonwealth with little oversight, notification, or transparency. "Though many cooks had a hand in the process, the resulting final bill was strengthened by advocates," said state Senator Jo Comerford, chair of the state's Joint Committee on Public Health, in an emailed statement to supporters. "I'm pleased that we were able to build in strong protections for both the environment and human health."

The Massachusetts Department of Public Health (DPH) had indicated that the state faced higher risks of mosquito-borne disease, particularly Eastern Equine Encephalitis (EEE), for which outbreaks generally last two or three years. The state saw 12 human cases of EEE and four deaths from the disease in 2019; EEE was also confirmed in nine livestock animals. In 2020, sporadic reports of EEE have been found, but the state considers the current risk level "low."

A coalition of advocacy groups urged that lawmakers improve safeguards within the legislation. The updated legislation ultimately passed by lawmakers improves transparency around making public health determinations, requires 48 hours prior notice to the public before mosquito spraying, sets a process to allow people and communities to opt-out of spraying, and sunsets all new powers within the bill after two years. Most importantly, over the course of the next two years, the legislation establishes a Mosquito Control for the Twenty-First Century Task Force, which will be overseen by a range of stakeholders. As Senator Comerford, who pushed for the task force, wrote, "Our current mosquito management system is a relic from the 1950s, and I am hopeful that the Task Force recommendations will lead to a more modern system that recognizes the latest evidence about effective mosquito management and environmental protection."

In the meantime, the bill will provide outsized powers to state officials to conduct mosquito spray campaigns throughout the state. Public Employees for Environmental Responsibility (PEER) has filed a complaint with the state Inspector General, challenging the efficacy of the state's adulticide-focused spray program. Responsibility (PEER), regarding the post efficacy

New York Bans Glyphosate (Roundup) on State Land

The New York State Legislature passed in July (and was signed by the Governor in December) a bill that bans the use of all glyphosate-based herbicides on state properties by December 31, 2021. Nevertheless, such piecemeal, state-by-state, town-by-town initiatives represent mere "drops" of protection in an ocean of toxic chemical pesticides to which the U.S. public is exposed.

The bill represents a piecemeal approach to regulating hazardous pesticides, as many communities across the country transition from chemical-intensive land management to organic systems that do not use toxic pesticides.

The bill—titled "An Act to amend the environmental conservation law, in relation to prohibiting the use of glyphosate on state property"—was introduced in 2019 and sponsored by New York State Assembly Member Linda B. Rosenthal (D/WF) and State Senator José Serrano (D,WF) adds a new subdivision to section 12 of the state's environmental conservation law, prohibiting "any state department, agency, public benefit corporation or any pesticide applicator employed thereby as a contractor or subcontractor to apply glyphosate on state property." More than 50,000 gallons of glyphosate-based herbicides were applied in public spaces across the entirety of the state, as reported in 2019 by Bronx.com.

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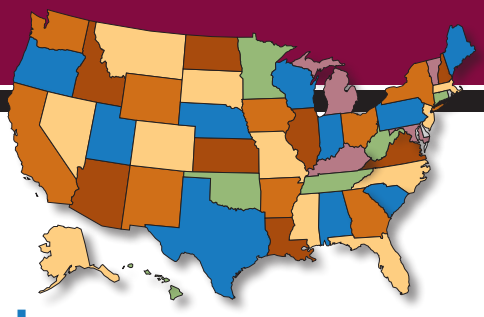
Bayer-Monsanto Chalks Up Court Victory that Takes Cancer Warning Off Roundup™—Glyphosate

A court decision in California, challenging a cancer warning on products containing the weed killer glyphosate, highlights the distinct ways in which scientific findings are applied under regulatory standards, in toxic tort cases evaluated by juries, and by consumers in the marketplace. These differences came into focus as a U.S. court quashed California's decision to require cancer warning labels on glyphosate products on June 22. The ruling, by Judge William Shubb of the U.S. District Court for the Eastern District of California, bars the state from requiring labeling that warns of potential carcinogenicity on such herbicides.

The 2015 cancer finding by the International Agency for Research on Cancer spurred the California Office of Environmental Health Hazard Assessment, in the same year, to announce that glyphosate would be listed as a probable cancer-causing chemical under *California's Safe Drinking Water and Toxic Enforcement Act of 1986* (Proposition 65 or Prop 65). With that announcement came another: the state would mandate that cancer warning labels be applied to glyphosate-based products in the state when any of four legal requirements were met.

Prop 65 requires businesses to "provide warnings to Californians about significant exposures to chemicals that cause cancer, birth defects, or other reproductive harm. Monsanto's campaign against glyphosate restrictions had been mostly unsuccessful, except that EPA declared in 2017 that glyphosate is likely not carcinogenic. Following California's Prop 65 listing in 2017, Monsanto sued the state to challenge that listing in Fresno County Superior Court and lost. The company then brought suit (along with a variety of industry stakeholders) against California in federal court in late 2017, claiming that the state's plan to require manufacturer labeling constitutes "unconstitutional forced speech." The court agreed and found that "California has [other] options available to inform consumers" of its listing.



PFAS "Forever Chemicals" Found in Mosquito Pesticide

Raises Concerns Over Widespread Contamination

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PFAS (per and polyfluorinated alykyl substances) "forever chemicals" are being detected in a commonly used mosquito pesticide known as Anvil 10+10, according to reporting in the *Boston Globe,* based on independent testing from a watchdog group and state regulators. PFAS are a large family of nearly 5,000 chemicals that may never break down in the environment and have been linked to cancer, liver damage, birth and developmental problems, reduced fertility, and asthma. The chemicals already disproportionately contaminate people of color communities, and there is evidence they reduce the efficacy of vaccines. While many may be familiar with PFAS for its use in nonstick cookware, electrical wire insulation, personal care products, food packaging, textiles, and other consumer goods, its presence within an already toxic pesticide is alarming. Perhaps most concerning, neither the manufacturer nor regulators have a good understanding of how exactly PFAS chemicals made their way into pesticide products.

"This is an issue that cuts to the core of what's wrong with our federal system for regulating pesticides," said Drew Toher, community resource and policy director at Beyond Pesticides. "The finding makes it imperative that EPA review and disclose full pesticide formulations before allowing the public to be exposed to unknown hazards."

Watchdog group Public Employees for Environmental Responsibility (PEER) conducted a preliminary test on Anvil 10+10 this fall, detecting presence of PFAS in a 2.5 gallon jug. "Our tests revealed that Anvil 10+10 contains roughly 250 parts per trillion (ppt) of perfluorooctanoic acid (PFOA), and 260–500 ppt of hexafluoropropylene oxide dimer acid (HFPO-DA), a GenX replacement for PFOA," the group wrote in a letter to EPA and state regulators. Concerned by the results, the Massachusetts Department of Environmental Protection initiated its own testing directly from 55 gallon drums of the product. Not only was PFAS found, some of the detections exceeded safety limits recently enacted by the state for drinking water. Although EPA does not currently regulate PFAS, it established a 70 ppt Lifetime Health Advisory for PFOA and PFOS in drinking water.

Because of the pervasiveness and persistence of PFAS, the chemical is showing up on farms and contaminating food. In Maine, according to the *Portland Press Herald*, "Milk from a Central Maine dairy farm contained levels of a harmful "forever chemical" that were 60 to 150 times higher than health standards, triggering a state investigation and raising new concerns about PFAS contamination on farms."

Living in Sync with Ecosystems Yields Farm Productivity and Health Benefits

Biological Control for Slugs Shows Promise

Researchers at Oregon State University recently made a promising discovery that could significantly improve the ability for North American farmers and gardeners to manage invasive, crop damaging slugs. It is not a "pesticide," but a nematode (*Phasmarhabditis* spp.), a microscopic animal whose phylum (closely related) contains potentially millions of different species. Oregon State researchers think they have found the specific type of nematode that will parasitize and kill *Deroceras reticulatum*, also known as the grey garden slug. The study underscores the critical importance of funding and supporting research on biological controls and other nontoxic pest management approaches.

Researchers were keyed into the potential to use nematodes for slug biocontrol by a product that has been successfully used in Europe for over 25 years, known as Nemaslug. However, the product is not registered by EPA. Study coauthor Rory Mc Donnell, PhD, said. "If we can provide evidence it's native, that makes a strong case for developing it as a bio-control. But we want to make sure there are no effects on native slugs or snails. We don't want bio-control gone awry. That's very, very important."

To determine whether slug-predator nematodes are present in the U.S., scientists took nematode samples from Oregon fields and compared them to the Nemaslug strain, as well as other nematodes found throughout the world. Through a series of tests and DNA sequencing, it was determined that the strain found in Oregon is nearly identical to those in Nemaslug. The only difference is the absence of one bacterial species usually found around the specific nematode, and in the Nemaslug product. Subsequent testing found that several nematode species found in North America have the potential to kill garden slugs.

Eating Organic Reduces Risk of Type 2 Diabetes

Reinforcing a body of scientific evidence, research finds that eating organic food lowers one's risk of developing type 2 diabetes. One in 10 (34 million) Americans are afflicted with type 2 diabetes, and one in three (88 million) with prediabetes.

The results of the study, "Prospective association between organic food consumption and the risk of type 2 diabetes: findings from the NutriNet-Santé cohort study," published by a team of French and American researchers in the *International Journal of Behavioral Nutrition and Physical Activity*, reinforce the triple bottom line benefits of organic food for public health, the environment, and the wider economy.

Scientists used data from NutriNet-Santé, a massive study including over 170,000 participants (averaging 52 years old) who regularly respond to questions concerning lifestyle, dietary intake, body type, physical activity, and health status. Roughly 33,000 NutriNet-Santé participants completed a food frequency questionnaire regarding how often they consume organic food. After four years, 293 surveyed individuals had been diagnosed with type 2 diabetes. Researchers then looked at how organic food consumption affected the risk of developing the disease, adjusting for body mass index, gender, family history of diabetes, physical activity, education, economic status, occupation, smoking, and alcohol consumption.

Higher organic food consumption was found to be inversely associated with the risk of developing type 2 diabetes. In fact, for every 5% increase in

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Ohio State University Extension

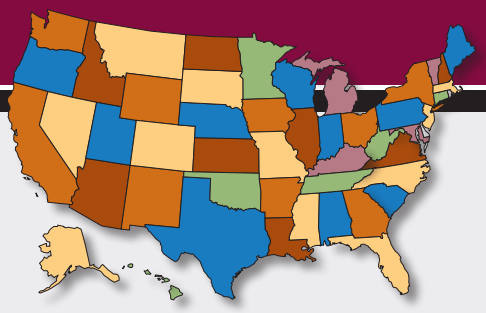
the proportion of organic foods in one's diet, risk of type 2 diabetes decreased by 3%. When comparing the group with the highest proportion of organic food in their diet to those with the lowest, individuals in the high consumption group were 35% less likely to develop the disease.

Crop Diversity Yields Benefits

A study by researchers at the University of California, Santa Barbara (UCSB), "The ecology of crop pests," published in *Science Daily* in November, finds that crop diversity in commercial agriculture is just as essential to supporting a stable biological system as plant diversity on noncommercial landscapes. Furthermore, less diverse crop areas lead to higher, more intensive pesticide use, indicating a threat to environmental and human health, as well as food security. Researchers note, "While [crop] complexity increases stability and reduces high deviations in insecticide use, accounting for crop and farmer-specific characteristics is crucial for statistical inference and sound scientific understanding."

Researchers evaluated how crop and landscape diversity affect pest populations, using insecticide use data as a surrogate for pest pressures from the Kern County Agricultural Commissioner (CAC), California, over the period 2005 to 2017. Crop data includes crop type, acceptable field size, field and farmer permit number, and active dates for the field. The research finds that more complex/diverse croplands and landscapes boast lower pest populations and lower levels of insecticide use. Furthermore, larger, less diverse croplands have higher concentrations of insecticide use with more variation in the type of pesticides used when compared to smaller, more diverse crop areas. The study's authors mention, "We find increasing cropland in the landscape and larger fields generally increase the level and variability of pesticides, while crop diversity has the opposite effect."

Since the 1940s, ecological theory maintains that greater diversity promotes the stability of an ecosystem. However, U.S. commercial agriculture and noncommercial landscapes have become more chemically dependent and less diverse. This study adds to the growing body of scientific research supporting the same conclusion that larger, monoculture croplands contain higher concentrations of pests, thus higher pesticide use. Pesticides, to control many wild plant species on noncommercial landscapes—mainly for aesthetic purposes—not only limits pollinator foraging habitat, but also causes harm to pollinators and other animals upon exposure.



Study Shows Organic Food Diet Reduces Glyphosate Residues in Body

Levels of the notorious herbicide compound glyphosate in the human body are reduced by 71% through a one-week switch to an organic diet, according to "Organic diet intervention significantly reduces urinary glyphosate levels in U.S. children and adults," published in *Environmental Research* in October.

The researchers write, "Recent research indicates that the increase in use of glyphosate has been paralleled by an increase in exposure of the human population, at least in the U.S. It was reported that urine glyphosate levels increased more than five-fold from the mid-1970s to 2014, and that the percent of the population with detectable urine glyphosate levels increased nearly 600%, representing more than 70% of the population."

Plant Diversity Enhances Productivity, Reduces Pesticide Use

Higher rates of plant diversity can limit pest pressure and reduce the need for pesticide use, finds a study published in "Biodiversity enhances the multitrophic control of arthropod herbivory" (*Science Advances*) in November.

With rampant declines in insect biodiversity from the ongoing insect apocalypse, it is critical that farmers and ecologists better understand the natural interplay between plants and insects, and the important ecosystem services that flow from these interactions. "Our experiments show that conserving plant diversity provides multiple benefits for controlling herbivore pests, which could play a key role in reducing inputs of agrochemicals and enhancing plant

productivity," said study coauthor Andrew Barnes, PhD.

Scientists investigated the importance of plant biodiversity by studying 487 arthropod food webs in two ongoing biodiversity experiments—one known as The Jena Experiment, based in Central Europe, and another, Cedar Creek Biodiversity Experiment, in the state of Minnesota. Both sites established blocks of plant diversity gradients, flowing from monoculture plots to those with 16 species or more. Researchers aimed to investigate how insect food webs and feeding behavior, plant biomass, and pest predator response changes as a function of plant biodiversity. Results show that higher plant diversity resulted in an insect (herbivore pest) feeding rate that is 44% lower than that found in areas containing a monoculture of only one plant species. Thus, greater rates of plant diversity may be expected to produce higher yields, on balance, than monoculture fields when pest pressure is taken into account. "That ultimately means that where multiple species are planted together, this will yield more plant biomass per square meter, and each individual plant in diverse mixtures will receive lower damage from herbivores," Dr. Barnes indicates.

Natural Areas Surrounding Farmland Critical to Reducing Pesticide Use

Natural areas around farmlands play an important role in managing pest outbreaks and therefore reducing insecticide use, according to "Landscape simplification increases vineyard pest outbreaks and insecticide use," published in the *Ecology Letters* in October. While industrial agriculture puts pressure on farmers to grow single crops on ever larger farms to achieve economies of scale, these monoculture landscapes have significant downsides for public health and the environment. "Overall, our results suggest that simplified landscapes increase vineyard pest outbreaks and escalate insecticide spray frequencies," said lead author Daniel Paredes, PhD, to the *Daily Democrat* (California). "In contrast, vineyards surrounded by more productive habitats and more shrubland area are less likely to apply insecticides."

To investigate the effect of nearby landscapes on farm pest pressure, the team of University of California, Davis scientists used a database created by the government of Spain. For 13 years, the government monitored 400 Spanish vineyards for the presence of the European Grapevine Moth. The moth is a notorious vineyard pest (discovered in California vineyards in 2009), laying three generations of eggs on grapes. In the first generation, the moth larvae will web and feed on flowers. In the second and third, they feed on berries, damaging harvests.

Results show that pest outbreaks above levels that cause significant economic damage are much more likely when farms are surrounded by other vineyards. The effect was particularly pronounced with the second and third generation of moths, which cause the most widespread damage. "At harvest, we found pest outbreaks increased fourfold in simplified, vineyard-dominated landscapes compared to complex landscapes in which vineyards are surrounded by semi-natural habitats," said Dr. Paredes.

Biological Management Has Added Billions in Benefits to Agricultural Economies

While the Green Revolution is often heralded in conventional agriculture circles as the key agricultural innovation of the last century, new research finds that biological controls has had the greatest beneficial impact on world crop production. The study, "Ecological Pest Control Fortifies Agricultural Growth in Asia–Pacific Economies," published in *Nature Ecology* and Evolution in August, finds that the introduction of predators to manage non-native pest species is just as important as the introduction of new cereal grain varieties.

"Our work constitutes an empirical demonstration of how insect biological control helped solidify the agrarian foundation of several Asia-Pacific economies and, in doing so, places biological control on an equal footing with other biological innovations such as Green Revolution germplasm," said study coauthor Michael Furlong, PhD, of the University of Queensland, Australia.

"Biological control delivered durable pest control in myriad Asia-Pacific agriculture sectors, permitting yield-loss recoveries up to 73%, 81% and 100% in cassava, banana and coconut crops respectively," said Dr. Furlong. "The ensuing economic dividends are substantial, as pest-induced losses up to US $6.8, $4.3 and $8.2 billion annually for the above crops were offset (at respective values of $5.4–6.8 billion, $1.4–2.2 billion and $3.8-5.5 billion/year, for a conservative to high impact scenario range). As many of the underlying programs were run on a shoestring, the rate of return on biological control science is extraordinary." Overall, the authors indicate that biological controls have brought approximately $20 billion to the Asia-Pacific farm economy on an annual basis.

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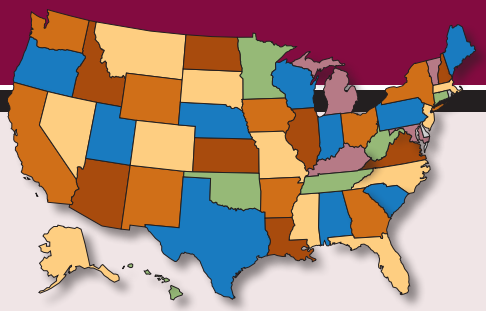

Managing Mosquitoes

Human Environment Increases the Prevalence of Disease Carrying Mosquitoes

Disease carrying mosquitoes are more likely to flourish in areas being altered by human activities, according to "Human practices promote presence and abundance of disease-transmitting mosquito species," published by scientists at Oregon State University in *Scientific Reports* in August. As climate change facilitates the spread of mosquitoes into new regions throughout the world, managers are struggling with the drivers of mosquito-borne disease in order to establish effective mitigation measures. "People care a lot about what environment a lion needs to succeed in; we've researched that extensively. But people don't do that with mosquitoes. We don't understand them as a group of species and how their ecology differs between species," said study coauthor Brianna Beechler, PhD, a disease ecologist and assistant professor of research in Oregon State University's Carlson College of Veterinary Medicine.

Authors of the study note that most mosquito collection occurs opportunistically, with samples taken at known mosquito breeding sites. To better understand mosquito spatial ecology, scientists conducted paired sampling at locations inside and outside South Africa's Kruger National Park, the largest nature preserve in the country. Each sample location inside the park was paired with another sample from a similar location (in terms of landscape and climatic conditions) in developing areas outside of the park. Human disturbance was measured by five factors, including (i) pesticide use, (ii) nutrient loading, (iii) human population density, (iv) biomass of grazing animals, and (v) loss of vegetation.

The research looks at the impact of these hazards on disease vector

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mosquitoes, which are not widely evaluated in this comprehensive context. Each of these impacts are significantly higher, by orders of magnitude, outside the park than inside. The findings show that mosquito abundance outside the part is determined to be an average 2.9 times (ranging between 1.5 and 10 times) greater than paired sites of similar layout inside the national park.

Mosquito Resistance to Pesticides Leads to 400,000 Malaria Deaths Worldwide

Efforts to control the transmission of malaria are encountering a big, though predictable, problem: the mosquitoes that transmit malaria are developing resistance to at least five of the insecticides that have been central to limiting transmission of the disease. A study released in June, "Mapping trends in insecticide resistance phenotypes in African malaria vectors," in PLOS Biology reveals a dramatic increase in resistance to pyrethroid insecticides and DDT across sub-Saharan Africa. This signals the failure of a mainstay chemical approach to the spread of malarial mosquitoes; this same problem—resistance—is happening with chemical management of agricultural insects and weeds, and with antibiotics to treat human bacterial infections. This study underscores a point Beyond Pesticides has made repeatedly: resistance to pesticides (whether insecticides, herbicides, biocides, fungicides, or medical antibiotics) is nearly inevitable. The solution to containing the spread of malaria lies not in the use of more and different chemicals, but in nontoxic approaches that respect nature and ecological balance.

Malaria can be a deadly disease caused by female *Anopheles* mosquitoes infected with any of four varieties of the *Plasmodium* parasite. The disease kills roughly 400,000 people annually, with half that mortality in sub-Saharan Africa. The U.S. sees approximately 2,000 cases of malaria annually, primarily in people returning from countries in south Asia and sub-Saharan Africa that deal with consistent malaria threats.

In such regions, primary control strategies for these mosquito vectors during the past couple of decades have been the insecticidal treatment of bed nets (known as ITNs), and indoor residual spraying (IRS) of insecticides on walls, floors, ceilings, and eaves prior to the intensive malaria transmission season. The development of mosquito resistance to these insecticides means that existing control programs, which promote ITNs and/or IRS, are becoming far less effective. Over the course of the last two decades, deltamethrin and λ-cyhalothrin (synthetic pyrethroids), and DDT have been used for IRS, but the authors note that other classes of insecticides, such as carbamates and organophosphates, are increasingly being used for IRS.

Consumer Reports Focuses on Reducing Pesticide Residues in Diet Not Use

Consumer Reports magazine (*CR*) issued a report, "Stop Eating Pesticides," in August, which offers consumers a rating system *CR* developed and employed to help identify "the health benefits from fruits and vegetables while minimizing [the] risk from toxic chemicals." In addition to providing its analysis and ratings of the pesticide risk of a variety of produce items, *CR* recommends eating organically grown and raised foods whenever possible. It also makes a host of recommendations on federal pesticide policies and emphasizes the importance of maintaining the integrity of the National Organic Standards (of the USDA-housed National Organic Program).

Advocates say it is important that this mainstream publication has arrived at many shared, science-based assessments of the risks of pesticides. While public disclosure of the risks of pesticides, and the limits of full knowledge of the complexities of pesticide hazards is important, a wholesale transition to organic and regenerative agriculture—rather than making the public figure out which fruits and vegetables are "safer" or "less safe"—is the real answer to the health risks of pesticides in the food supply, according to Beyond Pesticides. In addition, the *CR* system does not consider the effect of food choices on workers who handle and are exposed to pesticides, impacts on the communities where pesticides are used and produced, as well as the interrelationship of pesticide use with the climate crisis and biodiversity decline.

The *CR* analysis used data from the U.S. Department of Agriculture's (USDA) Pesticide Data Program for 2014–2018. Those pesticide residue data were compiled from tests of approximately 450 pesticides across 24,000 samples of 35 different fruits and vegetables. The analysis evaluated both conventionally grown, meaning produce that is typically treated with pesticides and synthetic fertilizers, and organically grown produce; it also reviewed both U.S. produced and imported items. *CR* based its ratings on four criteria: the number of pesticides found on each item, the average amount of residue of each pesticide found on the items, the frequency with which pesticides were found on samples, and the toxicity of the pesticides detected.

The *CR* report says that consumers "can minimize the risk by choosing fruits and vegetables grown with fewer and safer pesticides." To that end, the analysis proposes to "help consumers identify which produce poses the biggest risk from pesticides," and asserts that the "good news" is that nearly "half of the nonorganic fruits and vegetables pose little risk. But about 20 percent, such as fresh green beans, peaches, and potatoes, received our worst scores; those are the ones it's most important to try to buy organic. . . . For the lowest-scoring items, eating a half of a serving or less per day poses long-term health risks to a young child."

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Beyond Pesticides emphasizes that consumption of conventionally grown produce with chemical-intensive practices—even those items that score well in *CR*'s analysis—takes both environmental and social justice tolls at the sites of food production and processing. Farmworkers, ecosystems, and biodiversity are notoriously negatively affected by the use of pesticides. Beyond Pesticides executive director Jay Feldman notes: "We contribute to environmental racism when we eat conventionally grown food because the regulations and risk assessments that support our chemical-intensive food system institutionalize disproportionate risk for black and brown people." *CR* senior policy analyst Charlotte Vallaeys, PhD is quoted in the article: "The effects of pesticides on the people who grow and harvest our food is a big part of the reason *CR* recommends buying organic when you can."

Fashion Killer: Report Finds Apparel Industry Is a Major Contributor to Biodiversity Loss

The apparel industry becomes the latest focus of industries contributing to global biodiversity loss, directly linking soil degradation, natural ecosystems destruction, and environmental pollution with apparel supply chains, in the report *Biodiversity: The next frontier in sustainable fashion* by McKinsey & Company. Although there are many studies on the fashion industry's impact on climate change, much less research discusses the impact the industry has on biodiversity.

The globe is currently going through the Holocene Extinction, Earth's 6th mass extinction, with one million species of plants and animals at risk of extinction. With the increasing rate of biodiversity loss, advocates say it is essential for government agencies to hold the fashion industry accountable for the direct (i.e., excessive agrochemical use, water consumption) and indirect (i.e., water pollution from runoff) impacts on the environment, not only to protect the well-being of animals, but humans, as well. Study researchers note, "We expect biodiversity to become an even greater concern for consumers and investors in the coming years. Covid-19, instead of slowing the trend, has accelerated it—perhaps because people now understand more deeply that human and animal ecosystems are interdependent. It's time for the apparel industry, which to date has contributed heavily to biodiversity loss, to now make bold moves in the opposite direction."

When Can Schools Be Opened Safely During the COVID-19 Pandemic?

Steps needed to protect those in the school environment

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Despite pressure to reopen schools, concerns persist about the threat to the health of children, teachers, school staff, and families. The American Academy of Pediatrics (AAP) has taken the position "that all policy considerations for the coming school year should start with a goal of having students physically present in school."

There are many complex social, scientific, and logistical issues involved in a decision to reopen schools for in-person teaching. The National Education Association (NEA), American Federation of Teachers (AFT), National Parent and Teacher Association (PTA), and others call for a well-thought-out approach to reopening schools only when it is shown to be safe for all. Criteria mentioned by these organizations include:

- The pandemic is under control in the community—as evidenced, for example, by an average daily community infection rate among those tested for COVID-19 below five percent and a transmission rate below one percent.
- Protections have been put in place to keep the virus under control and protect students and staff. These include accommodations for students and staff at high risk; measures and building retrofits to protect against all forms of transmission; procedures for detecting disease, quarantining, and notification; involvement of families and educators in decisions; monitoring; and enforcement.
- Plans are in place that ensure continuous learning equitably for all students, with training for educators, families, and students in the process of virtual instruction, and access to devices and high-speed internet for every student and teacher.

From a practical perspective, the question of whether schools can comply with public health recommendations looms large. How do schools operationalize student use of face masks, distancing, and manage surface and air contamination with the virus?

Who Is at Risk?

RISKS OF COVID-19

The risks of reopening schools come from both COVID-19, caused by the SARS-CoV-2 virus, and the measures that schools may take to protect students, family members, teachers, and staff. The health risks from the virus to young children (elementary school age) appear to be smaller than the risks to adults, although transmission or spread of the virus to adults is of concern to public health officials.

A preliminary investigation of U.S. pediatric COVID-19 cases finds that relatively few children are hospitalized with COVID-19, and fewer children than adults experience fever, cough, or shortness of breath. However, severe outcomes, including death, are reported in children. A relatively rare consequence of COVID-19 in children and adolescence is multisystem inflammatory syndrome, which can produce serious and life-threatening illness.

In view of the epidemic of asthma, the risk of asthmatic children contracting COVID-19 is another consideration. Research on the connections between asthma and COVID-19 points in different directions. The strongest connection between asthma and COVID-19 involves nonallergenic asthma. While most asthma in children is associated with allergies, there remain questions about chemical exposures initiating or promoting asthma.

In spite of the low incidence of serious illness, many children are infected with the virus without expressing symptoms, or before expressing symptoms. Asymptomatic persons, including children, may carry a high viral load. Children may infect teachers and other workers in the school. If they become infected, they may bring the disease home, where they may transmit the virus to parents, grandparents, and other vulnerable family members.

RISKS OF DISINFECTANTS AND DISINFECTING

As schools closed last year, attention was focused on virus-contaminated surfaces. While the U.S. Environmental Protection Agency (EPA) has certified a large number of disinfectants as effective against SARS-CoV-2 (List N), many of these chemicals are hazardous and actually weaken the respiratory, immune, and nervous systems. At the same time, there are many safer disinfectants on EPA's list that are effective against the virus. *(See* bp-dc.org/disinfectants.*)*

As the science shows, some people are more vulnerable to the effects of the virus than others. These are generally people who have a preexisting condition (comorbidities) or are of advanced age, who may have a weakened immune or respiratory system. With the management of viral and bacterial infections, it is always important not to exacerbate the risk to individuals in the process of avoiding or controlling the threat. In the case of COVID-19, there are measures of protection—both practices and products—that can provide protection without using toxic products that increase risk factors. Beyond Pesticides continues to evaluate and post on its website materials on EPA's List N, with a focus on avoiding those that threaten immune and respiratory systems.

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Some Hazardous Disinfectants

Disinfectants that affect the respiratory and immune systems are especially hazardous during the pandemic and should be avoided. The following are some of the worst.

Quaternary ammonium compounds (QACs or quats) include several disinfectants on List N. Quats are mutagens and reproductive toxicants and are known to increase the risk of asthma and allergic sensitization. Known genes for microbial resistance to quats may also contribute to antibiotic resistance.

Chlorine compounds include household bleach (sodium hypochlorite), chlorine dioxide, and hypochlorous acid. They can irritate eyes, burn respiratory tissues, and contribute to asthma.

Phenolic compounds include a wide range of toxic chemicals, including cresols, hexachlorobenzene, and chlorophenols. Health effects from breathing or exposure to the skin include headaches, burning eyes, muscle tremors, skin burns, irregular heartbeat, severe injury to heart, liver, kidneys, and lungs, cancer, and death.

Peroxyacetic acid (peracetic acid) acts quickly against all microorganisms and lacks harmful breakdown products. However, it is considered by the Association of Occupational and Environmental Clinics to cause asthma by respiratory sensitization and can cause dangerous damage to eyes and skin.

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FOGGING AND MISTING

In terms of disinfecting surfaces, where half-lives (an indicator of the time of potential exposure) of the virus range up to 6.8 hours,19 school districts have been concerned with the costs involved in repeated disinfectant applications. In the interest of disinfecting many classrooms quickly, schools have been investigating, and sometimes investing in, devices that apply disinfectants as a fog or fine mist into the indoor ambient air. Such devices pose special risks, as a result of inhalation or absorption from resulting surface residues.

Fogging reduces disinfectant efficacy. First, devices are not registered by EPA. This includes ozone generators and UV lights. It also includes some application devices like foggers. EPA does not generally recommend fogging applications, or wide area spraying of disinfectants, to control COVID-19 and warns, "A disinfectant product's safety and effectiveness may change based on how it is used. If a pesticide product's label does not include disinfection directions for use with fogging, fumigation, wide-area, or electrostatic spraying, EPA has not reviewed any data on whether the product is safe and effective when used by those methods." In 2013, EPA sent a letter requesting supporting data to those manufacturers whose antimicrobial (disinfection) products claim to control microorganisms when applied by fogging or misting.

EPA cites the following reasons for believing that fogging and misting are not adequately effective:

- Application by fogging/misting results in much smaller particle sizes, different surface coverage characteristics, and potentially reduced efficacy when compared to sanitization or disinfection product applications by spraying, sponging, wiping, or mopping.
- The absence of pre-cleaning in the presence of soil contamination, potential reaction with or absorption of the active ingredient for different surfaces, and humidity/temperature fluctuations can also impact distribution and efficacy of the product.
- A surface treated by fogging/misting does not receive the same amount of active ingredient per unit area as the standard methods of application and, as a result, product efficacy may be greatly reduced.

Cleaning must precede disinfecting. Second, in order to be effective, disinfectants must be applied to clean surfaces. EPA refers to the Centers for Disease Control and Prevention's (CDC) recommendation to clean and disinfect surfaces, using a detergent or soap and water prior to disinfection.

Fogging and aerosols adversely affect lungs. Finally, fogs and fine mists are aerosols of very small particles that can be carried deep into the lungs, where they cause more damage.

According to the American Lung Association, "The differences in size make a big difference in where particles affect us. Our natural defenses help us to cough or sneeze some coarse particles out of our bodies. However, those defenses do not keep out smaller fine or ultrafine particles. These particles get trapped in the lungs, while the smallest are so minute that they can pass through the lungs into the bloodstream, just like the essential oxygen molecules we need to survive." Foggers produce a distribution of droplet sizes of 15-60 um (micrometer).

ELECTROSTATIC SPRAYERS

Electrostatic sprayers apply a positive charge to an area-wide spray as it leaves the nozzle, which causes droplets to be attracted to negatively charged surfaces. Users claim better, 360 degree coverage when using electrostatic sprayers to disinfect a room. EPA has made it a priority to evaluate electrostatic sprayers as a delivery mechanism for disinfectants on List N. Canadian research shows that application of disinfectant with an electrostatic sprayer can reduce microorganisms on student desks by 41% when used alone as opposed to conventional cleaning and disinfecting, which reduces microbes by 42%. Electrostatic application of disinfectant *after conventional surface cleaning and disinfecting* can reduce virus levels by an additional 26%.

Fogging does not save labor time. There are several caveats to the use of electrostatic sprayers. First, charged particles may be deposited on the applicator, including in the nose, so personal protective equipment (PPE), said to be optional in advertising, should be used. Second, CDC recommends cleaning first to ensure greater efficacy of disinfecting, and it is not clear that spraying disinfectant saves very much time if it is necessary to first clean the surfaces. Paper and other absorbent materials must be removed from the space where the spraying is conducted. Finally, as the numbers above show, electrostatic application of disinfectant is not as effective as conventional cleaning and disinfection.

In the future, it is possible that electrostatic sprayers may improve, and be subject to independent efficacy review by EPA. The issues of the need to pre-clean, remove papers, and provide PPE will remain. Thus, if the goal is to provide a quick application method that does not require hands-on treatment, then no area-wide spraying is adequate at this time.

THE SPREAD OF COVID-19 IS MOSTLY AIRBORNE

We now know that the spread of the SARS-CoV-2 virus is mainly person-to-person through the air, although spread through contaminated surfaces does play a role. The virus can remain infective as aerosol for at least three hours (half-life of about 1.1 to 1.2 hours), though with some loss of infectiveness. A recent study finds, "replication of SARS-CoV-2 in older children leads to similar levels of viral nucleic acid as adults, but significantly greater amounts of viral nucleic acid are detected in children younger than 5 years." With average class sizes ranging from 15 to 24 students across elementary and secondary schools, and an average class time of more than 6 hours per day, the potential for spread of the virus can be great in the absence of controls of airborne virus. None of the disinfectants—even those applied as fog—control airborne virus.

Minimizing Risk of Reopening

SCHOOL BUILDINGS

In school buildings, where both surfaces and air can serve as sources of infection, schools must pay attention to both routes of exposure. It is important, in disinfecting surfaces, to choose both a disinfectant and a mode of application that do not add risk to students, teachers, and custodial staff. Beyond Pesticides reviews disinfectant materials and updates recommendations regularly on its website.

Application of disinfectants as a fog or mist is not recommended. Legally, a disinfectant may not be applied as a fog or mist unless labeled for such a use. In addition, some disinfectants, while labeled for fogging, may not kill the coronavirus. EPA's List N identifies which application methods are considered effective, in the column labeled, "To kill SARS-CoV-2 (COVID-19), follow disinfection directions for the following pathogen(s)." Electrostatic spraying, as discussed above, is thus far an unproven technology. EPA recommends that those with asthma or other respiratory conditions "[u]se products that could reduce your inhalation exposure, such as wipes or dampened towels, to disinfect surfaces. These options will substantially lower inhalation exposure compared to

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Quaternary Ammonium Compounds

Quaternary ammonium compounds, also known as "quats" or "QACs," include a number of chemicals used as sanitizers and disinfectants, including benzalkonium chloride, benzethonium chloride, cetalkonium chloride, cetrimide, cetrimonium bromide, cetylpyridinium chloride, glycidyl trimethyl, ammonium chloride, and stearalkonium chloride.[1]

In general, quats cause toxic effects through all routes of exposure, including inhalation, ingestion, dermal application, and irrigation of body cavities. Exposure to diluted solutions may result in mild irritation, while concentrated solutions are corrosive, causing burns to the skin and mucous membranes. They can produce systemic toxicity and can also cause allergic reactions.[2]

ASTHMA AND ALLERGIES

Of particular interest with regard to use as disinfectants in the COVID-19 pandemic, quats increase the risk for asthma and allergic sensitization. Evidence from occupational exposures shows increased risk of rhinitis and asthma with exposure to quats. Quats are on the Association of Occupational and Environmental Clinics list of asthmagens and may be more potent than bleach.[3]

One quat, benzalkonium chloride, has also been associated with dermatitis.[4] Quats appear to be sensitizers and irritants to the skin and mucous membranes. Particular quats are suspected to display an immunologic cross-reactivity between each other and with other chemical compounds containing ammonium ion, such as muscle relaxants widely used in anesthesia.[5]

MUTAGENICITY

Some quats are shown to be mutagenic and to damage animal DNA and DNA in human lymphocytes at much lower levels than are present in cleaning chemicals.[6]

ANTIMICROBIAL RESISTANCE

Genes have been discovered that mediate resistance to quats. There has been an association of some of these genes with beta lactamase genes, raising concern about a relationship between disinfectant resistance and antibiotic resistance.[7]

REPRODUCTIVE TOXICITY

Mice whose cages were cleaned with QACs had very low fertility rates.[8] Exposure to a common quat disinfectant mixture significantly impairs reproductive health in mice.[9]

CONCLUSION

Avoid sanitizers and disinfectants containing quats, which have potential mutagenicity and reproductive toxicity and are known to increase the risk of asthma. See the Beyond Pesticides disinfectants and sanitizers webpage (*bp-dc.org/disinfectants*) for information about safer disinfectants and our article on safe return to school during the COVID-19 pandemic (*bp-dc.org/backtoschool*).

NOTES

1 International Programme on Chemical Safety INCHEM Internationally Peer Reviewed Chemical Safety Information, *http://www.inchem.org/documents/pims/chemical/pimg022.htm*.

2 International Programme on Chemical Safety INCHEM Internationally Peer Reviewed Chemical Safety Information, *http://www.inchem.org/documents/pims/chemical/pimg022.htm*.

3 Holm, S.M., Leonard, V., Durrani, T. and Miller, M.D., 2019. Do we know how best to disinfect child care sites in the United States? A review of available disinfectant efficacy data and health risks of the major disinfectant classes. American journal of infection control, 47(1), pp.82-91. *https://www.ajicjournal.org/article/S0196-6553(18)30731-4/fulltext#sec0018*.

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5 Lim, XiaoZhi, 2020. Do we know enough about the safety of quat disinfectants? Chemical and Engineering News, vol. 98, issue 30. *https://cen.acs.org/safety/consumer-safety/know-enough-safety-quat-disinfectants/98/i30*.

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8 Holm, S.M., Leonard, V., Durrani, T. and Miller, M.D., 2019. Do we know how best to disinfect child care sites in the United States? A review of available disinfectant efficacy data and health risks of the major disinfectant classes. American journal of infection control, 47(1), pp.82-91. *https://www.ajicjournal.org/article/S0196-6553(18)30731-4/fulltext#sec0018*.

9 Melin, V.E., Potineni, H., Hunt, P., Griswold, J., Siems, B., Werre, S.R. and Hrubec, T.C., 2014. Exposure to common quaternary ammonium disinfectants decreases fertility in mice. Reproductive toxicology, 50, pp.163-170.

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sprays, which generate aerosols." There does not appear to be a shortcut to cleaning and disinfecting safely and effectively.

The safest way to minimize the chance of contracting COVID-19 through the air is to minimize time spent indoors where infected individuals are or may have been and practice social distancing with masks when with others both indoors and outdoors. Schools that do decide to reopen indoor classrooms for in-person instruction will need to take precautions to remove viruses from the air. If schools can be retrofitted with engineering controls for air exchange and filtration, virus removal may be maximized. Such removal will still require the use of social distancing and face coverings in order to minimize exposure from larger droplets that do not remain suspended in the air, as well as surface cleaning and disinfection and handwashing.

Engineering controls include increasing ventilation with outside air, improving natural ventilation, use of evaporative coolers in hot, dry climates, improving the HVAC (heating, ventilation, and air conditioning) system, and use of a portable air cleaner or purifier. Ultraviolet (UV) light is also being investigated for its effectiveness in deactivating the virus. Critically, it is important to pay attention to patterns of air flow as well as rates of ventilation and purification. One early indicator of the importance of airborne transmission of the virus came from a restaurant in Guangzhou, China, where a presymptomatic person infected 10 others who were downwind of the infected person in the air conditioning airflow. The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) offers advice to retrofit and improve HVAC systems. ASHRAE recommendations include:

- Use the highest filtering efficiency (minimum efficiency reporting value, or MERV) consistent with the specification of the HVAC system. HEPA or MERV 13 is the recommended minimum if equipment can accommodate pressure drop and MERV 14 is preferred.
- Introduce portable, all electric HEPA/UV machines in each classroom, with at least two air rotations per hour.
- Ensure flow patterns maximize mixing of air in classrooms.
- Change the start of operation hours (e.g., change 6 am start to 4 am).
- Run dedicated outdoor air systems for two hours before and after occupancy.
- If possible, designate a "Purge/Flush" mode for operations to minimize the virus transmission via HVAC systems.
- Follow ASHRAE guidelines for energy recovery.

Transportation

Transportation cannot be ignored because it is an area of high transmission with numerous touch points and shared air

Letter to Local Officials and Governor

I am writing because I am very concerned that schools are being pressured to reopen before they can do so safely—and lack the resources to ensure the safety of in-person classes. I am concerned that some schools seem to view unsafe disinfection measures—such as fogging—as necessary shortcuts in view of staffing and funding shortfalls.

I join with the National Education Association, American Federation of Teachers, National Parent and Teacher Association, and others in asking you to do your part to ensure the safety of all in our schools—students, teachers, and other staff.

The safety of all in our schools will require:

- Delaying reopening until the pandemic is under control in the community—as evidenced, for example, by an average daily community infection rate among those tested for COVID-19 below 5% and a transmission rate below 1%.
- Protections to be put in place to keep the virus under control and protect students and staff. Since we now know that the virus is airborne, upgrades to heating, ventilation, and cooling (HVAC) systems will be essential. Transportation must be included.
- Plans—developed in cooperation with the school community—to be in place to ensure continuous learning equitably for all students.
- Federal funding to support upgrades to buildings, buses, and electronic devices and access.

Already, funding falls short of that required for the upkeep and upgrade of school buildings. A report issued by the Government Accountability Office (GAO) on June 4, 2020 finds, "About half (an estimated 54 percent) of public school districts need to update or replace multiple building systems or features in their schools, according to GAO's national survey of school districts." The upgrades or retrofits needed to protect students and staff from the coronavirus are in addition to those repairs, although in some cases—such as the 41% of upgrades needed for HVAC systems—COVID-19 protection could take the place of already-needed upgrades. Nevertheless, additional funding will be required to make facilities and transportation safer and pay for day-to-day maintenance and disinfection.

Thank you for your consideration of our children's health.

space, raising similar issues to building spaces. Increased use of private transportation to schools will increase air pollution (which aggravates the respiratory system) and place higher burdens on those who cannot afford it. ASHRAE offers guidance for safe travel and maintenance of systems on transit vehicles. In addition to the personal measures of distancing, wearing face coverings, and washing hands, the organization suggests:

- Ventilation should be adjusted to the maximum consistent with the equipment's design.
- Allow operable windows to increase air flow.
- Change to HEPA (high efficiency particulate air) filters, but only when consistent with the manufacturer's recommendations, in order to avoid damage and voiding of the warranty.
- Follow recommended maintenance practices.

ASHRAE does not recommend use of UV disinfection in mass transit vehicles because it can cause break down of some materials, is potentially harmful to humans if they are directly exposed, and requires specific application times to be effective.

Costs

Reopening schools safely will not be inexpensive. A report issued by the Government Accountability Office (GAO) on June 4, 2020 finds, "About half (an estimated 54 percent) of public school districts need to update or replace multiple building systems or features in their schools, according to GAO's national survey of school districts." The upgrades or retrofits needed in an attempt to protect students and staff from coronavirus transmission are in addition to GAO-cited repairs, although in some cases—such as the 41% of upgrades needed for HVAC systems—COVID-19 protection could take the place of already-needed upgrades. Nevertheless, additional funding will be required to make facilities and transportation safer and pay for day-to-day maintenance and disinfection.

Conclusion

While individual schools and school districts face difficult decisions regarding the need to reopen schools, doing so safely will require an investment in infrastructure and staffing. Unfortunately, because of elevated rates of infection and a lack of uniformity in the use of preventive measures (masks and distancing), schools do not exist in a vacuum and face serious challenges in maintaining a safe space for children, teachers, staff, and their families within a wider community environment in which the virus may be widespread.

For a printable version of this article with scientific sources cited, please go to bp-dc.org/backtoschool.

COVID Crisis Sparks a Reimagining of Maui's Food System

The loss of tourism served as a catalyst to create a food hub and a new local food system infrastructure

AUTUMN NESS

As Maui continues to struggle with the impacts of COVID-19 related shutdowns, a new nonprofit has linked arms with Maui's small farms to support them through the crisis, while also laying the foundation for long-term food system change. Tourism shut down in March 2020, causing reduced demand for local produce from hotels and restaurants, while crowds were showing up at big box stores, buying food shipped in from all over the world, leaving store shelves empty.

Community leaders quickly organized to connect local consumers to Maui's farmers through the Maui Hub, an online "farmers market" where consumers can buy vegetables and other locally produced goods directly from the producer. The food hub is a consumer-friendly platform that also focuses on meeting the immediate needs of our small farms.

CONNECTING CONSUMERS WITH FARMERS

The response from the community and the farmers has been truly amazing. From the first week of operation in April 2020, during the height of lockdown chaos and anxiety, the Maui community stepped up to support our local farmers, and sales have increased nearly every week since. The Maui Hub team focuses on making the farmers' experience as easy as possible, by taking their delivery and paying them right away, so they can go back to the farm while community people do the rest of the work to get their produce to the consumer. The Maui Hub focuses on sales, marketing, and consumer education so we have more engaged and informed customers. We ask farmers what they need, and we do what we can to provide it.

We are also creating jobs and entrepreneurial opportunities in an economic sector that can no longer rely on tourism. We employ a packing and delivery crew, and help aspiring product entrepreneurs find gaps in the food market and connect them to farmers who grow what they need.

BUILDING A LOCAL FOOD SYSTEM INFRASTRUCTURE

The relationships we are building with our farmers will also give us the chance to support their conversion to organic

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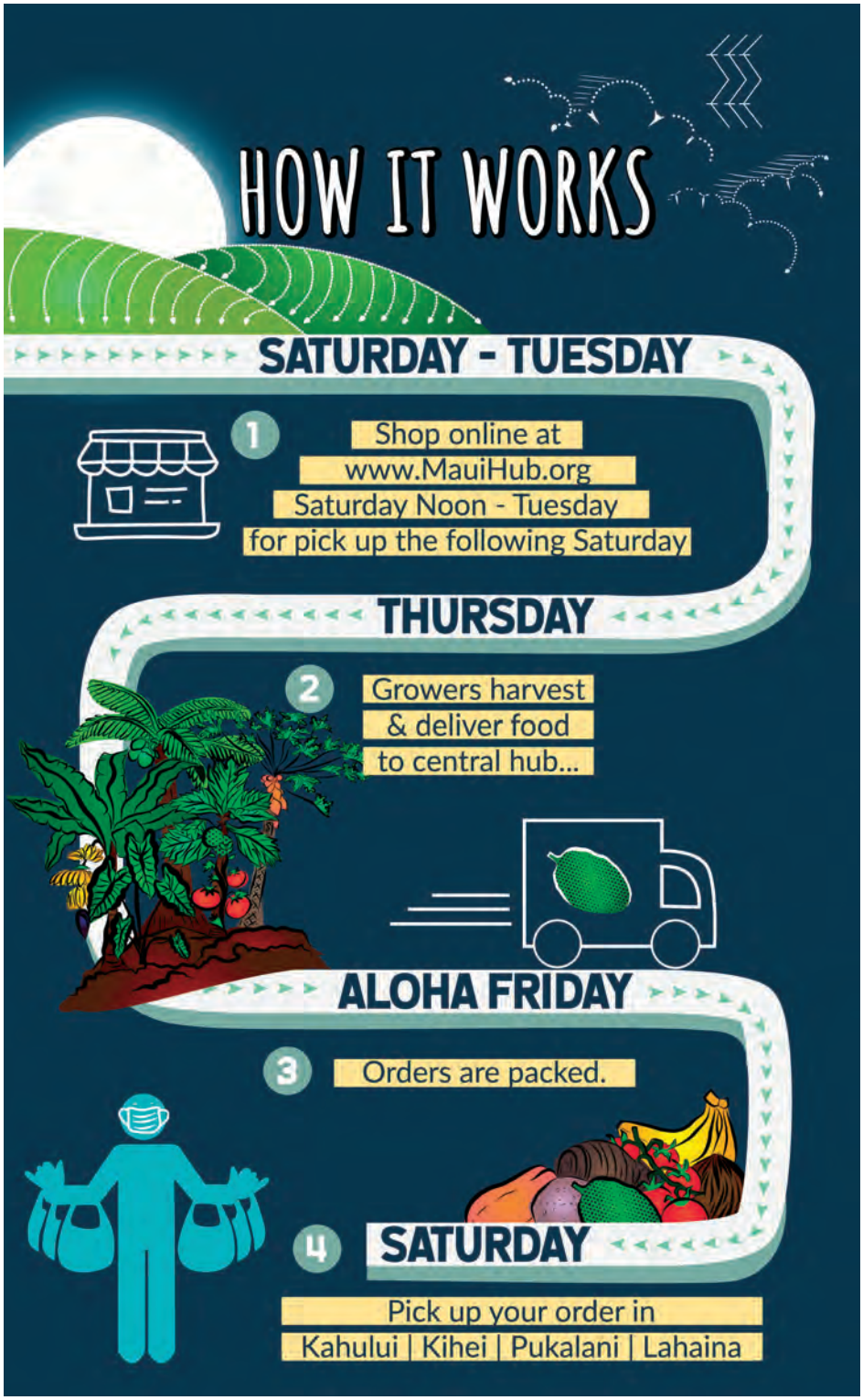


Poster artwork: Michelle Halcomb, Three Kisses Design

This poster advertises to residents of Maui how the food hub operates. Autumn Ness, director of Beyond Pesticides' Organic Land Management Program, helped join the farm community with consumers to advance food security and sovereignty on the island.

practices, as we now have the metrics to prove that Maui consumers want more organic produce. Building a local food economy, while also making sure our future is organic, is a win-win, that was less possible before COVID.

Maui has actually needed better infrastructure to support locally produced food for years. Without it, many farmers and producers have been largely on their own when it comes to selling and distributing their produce. When individual farmers have to manage the sales, aggregation, delivery, and invoicing for their products, that means they have much less time on their farm. This has been the topic of policy discussions and farm needs assessments for years, but there was never the political will or the resources dedicated to building out a functioning food hub.

A sustainable food system depends on collaboration, farm support, and informed consumers. We can no longer expect farmers to shoulder 100% of the burden of feeding our communities. They need support. If we restructure our food system with these core values, our farmers have the tools they need to increase their food production, creating jobs and making Maui more food secure.

The future of our food system, as well as the long-term health of our people and local economy, depends on the choices we make during this pandemic, and how we turn those choices into long-term systemic change.

Beyond Pesticides Hawai'i has always been actively involved in supporting our local organic farmers, but the pandemic put their challenges front and center. We are proud to be part of the Maui Hub team, and proud of our community and our farmers for the work they put in to getting our community through the pandemic, while also keeping an eye on the horizon.

Food security and a diversified economy has never been so urgent and through collaboration and values-based solutions, we are moving in the right direction. Together, we are Maui strong.

To find out more about the Maui Food Hub, visit www.mauihub.org.

Abandoning Science

A look back at the failure to regulate the neurotoxic insecticide chlorpyrifos

iStockphoto/Skyhobo

JAY FELDMAN AND DEBRA SIMES

There are many U.S. Environmental Protection Agency (EPA) decisions over the last four years that abandon the underlying principles of protecting health and the environment. The neurotoxic insecticide chlorpyrifos was among the first in 2017 that caught national attention because of EPA's blatant failure to respond to the scientific findings of brain damage in children. It also captured for the nation the ability of an agency, established to rely on science and protect public health, to be politicized and captured by the corporations that it is charged with regulating. In the early days of the Trump administration, EPA officials reversed an Obama administration proposal to ban agricultural uses of this chemical, whose residential uses, for the most part, had been banned nearly two decades earlier. One could point to this case as deserving of immediate attention by a Biden administration EPA, as a test of whether science will govern the process of what was envisioned as a scientific agency. It is one of dozens of decisions that have ignored science with dire consequences. Of course, corrective action on chlorpyrifos and other pesticides should not define progress in an EPA that needs to play a leadership role across government agencies in tackling problems of environmental justice (disproportionately high risks to people in communities of color), farmworker and landscaper (and other service providers) poisoning, pollinator and biodiversity decline, water quality degradation, crop damage and increasing pesticide dependency in genetically engineered crops, and the climate crisis.

EPA continued its politicization of science in the waning days of the Trump administration, when on December 4 the agency announced a proposed interim decision on chlorpyrifos, functionally continuing its registration for many agricultural uses. The interim decision purports to put in place new limitations on use of this pesticide, but they are wholly inadequate to the threat this compound represents—to young children, most concerningly, as well as to farmworkers, critical species and ecosystems, and the public. Chlorpyrifos should not be reregistered for use—i.e., its sale and use should be banned altogether, as Beyond Pesticides has asserted for years.

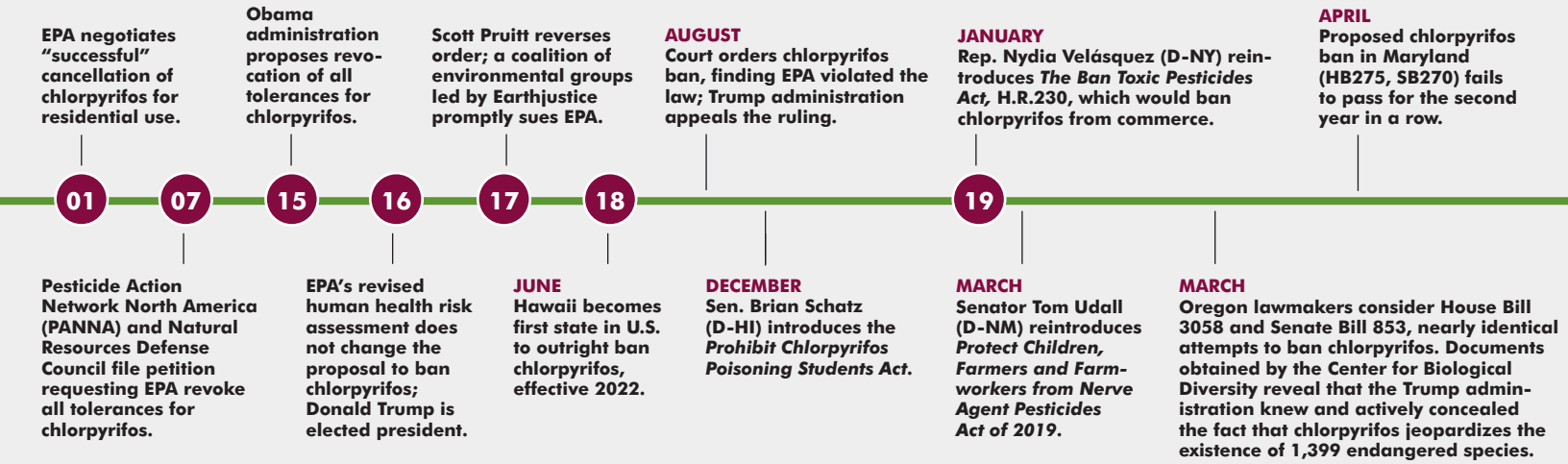
THE PROBLEM WITH CHLORPYRIFOS

Chlorpyrifos is an organophosphate pesticide used on scores of food crops, for mosquito (and other pest) control, and for some turf management (golf courses, especially). The compound is a central and peripheral nervous system poison and is clearly dangerous. It damages the brains of young children, causing impairment to cognitive function, lower IQs, attention deficit disorder, developmental delays, and other learning and developmental disorders. It can cause damage to human reproductive, endocrine, renal, hepatic, and immune function.

Federal and State History

In April 2019, Beyond Pesticides provided a timeline of relevant developments whose highlights are worth reviewing. Beyond Pesticides has reported on the tortuous path of EPA's relationship, as well as legislative, legal, and state responses, to chlorpyrifos.

Since April 2019, there have been more developments.



Chronic exposure has been linked to the development of lung cancer. In addition, chlorpyrifos is toxic to birds, fish, aquatic organisms, and bees. In areas where it is used, chlorpyrifos can contaminate indoor air, surface water, and food crops (most commonly, almonds, cotton, citrus, grapes, corn, broccoli, sugar beets, peaches, nectarines, soybeans, Brussels sprouts, cranberries, alfalfa, peanuts, sunflowers, and tree nuts). Farmworkers and their families, as well as pregnant women in such agricultural areas, are at particular risk for damage from the chemical and its drift.

The Center for Food Safety (CFS) writes: "The interim 'decision' leaves much undecided, including safety thresholds for chlorpyrifos exposure and possible mitigation measures, which EPA is currently negotiating with chlorpyrifos manufacturers." CFS also excoriates this latest decision: "EPA has long been aware of the pesticide's toxicity. While most residential uses of chlorpyrifos were banned nearly two decades ago, the agency permitted its continued use in agriculture, creating a double-standard in which rural kids and farmworkers are left unprotected. People are exposed to chlorpyrifos in food and water, but also through inhalation of spray drift and vapor."

CFS legal director George Kimbrell commented on the interim decision: "True to form, the Trump Administration has placed corporate dollars over public health. If allowed to stand, its proposal to continue registering this neurotoxic insecticide would cause irreparable harm to farmworkers and future generations. Everything possible must be done to ensure the Biden Administration reverses this proposal…"

NEW RESEARCH, OLD PROBLEMS

Beyond the exposure assessment that found brain effects in children exposed to chlorpyrifos, research published in July 2020, "Flawed analysis of an intentional human dosing study and its impact on chlorpyrifos risk assessments," (Sheppard, et al., *Environment International* 143(2020)105905) found that critical data supporting EPA's "safe exposure limit" were flat out wrong. According to the study by University of Washington (UW) researchers, the 1972 "Coulston Study" concluded that the amount of the chemical to which a human could be exposed before adverse effects showed up (the "no-observed-adverse-effect-level," or NOAEL) was *more than twice as high* as should have been determined had the study not ignored critical data. In addition, the study points to the perennial "fox guarding the hen house" issues at EPA, which include using research commissioned, funded, or even conducted by industry as any basis for regulation.

The researchers reanalyzed that human intentional dosing study using both the original statistical methods and modern computational tools that did not exist in the 1970s. (An important side note: such a study is unethical by current research standards.) The new analysis finds two significant flaws: (1) the study design made it less able to identify a treatment effect (an impact of the study subjects' intentional exposure to chlorpyrifos), and (2) the researchers' omission of valid and important data obscured a treatment effect that would otherwise have been identified.

In the study paper, the coauthors say plainly, "The Coulston Study misled regulators by omitting valid data for the key treatment group . . . resulting in a finding of no effect. Our updated analysis indicates that even the lowest dose was unlikely to be a NOAEL. A proper analysis of the Coulston Study would have lowered or eliminated the NOAEL. Either action would have reduced the acceptable dose for chlorpyrifos, and may well have led to more restrictions on its use,


EPA Admin. Scott Pruitt


Sen. Brian Schatz


Sen. Kirsten Gillibrand


Gov. Andrew Cuomo


Rep. Nydia Velásquez


Sen. Tom Udall

All Photos: Alamy Stock

APRIL
Senator Kirsten Gillibrand (D-NY introduces *Safe School Meals for Kids Act* to restrict schools from purchasing or serving food with any detectable amount of chlorpyrifos.

OCTOBER
California announces an early 2020 ban on use of chlorpyrifos.

FEBRUARY
Corteva (formerly DowDuPont) announces it will stop producing chlorpyrifos in 2020 because of declining sales.

AUGUST
A study reveals that research underpinning chlorpyrifos registration by EPA left critical data out of its analysis, resulting in decades of use of a faulty EPA "safe exposure limit."

20

MAY
New York State legislature passes a bill to phase out and eventually ban the use of chlorpyrifos.

DECEMBER
NYS Governor Cuomo vetoes the legislature's bill, but orders the state Department of Environmental Conservation to ban aerial applications immediately and all uses by 2021, using rulemaking rather than legislation; this makes it the third state to ban the toxic compound.

MARCH
The Maryland legislature passes a limited ban on chlorpyrifos. Maryland Governor Hogan vetoes the bill in May, preferring regulatory action.

SEPTEMBER
EPA—contravening scientific evidence and its own findings—announces its conclusion that "the science addressing neurodevelopmental effects [of the insecticide chlorphyrifos] remains unresolved.

particularly in scenarios where infants and children were exposed. . . . An earlier reduction in the NOAEL and increased exposure mitigation would have likely reduced the incidence of adverse health effects in children of that era. It is tragic that an omission of valid data from the analysis of the Coulston Study may have adversely impacted public health for at least 15 years."

Put simply: the "acceptable" chlorpyrifos exposure level established by EPA, on the basis of the 1972 research, was much higher than it should have been, and likely led to many, many dangerous exposures for children, in particular. Lead author Lianne Sheppard, PhD, commented, "This has huge public health implications. This study was the basis of policy for over 15 years and because it concluded that the 'no observed adverse effect level' was more than twice as high as it should have been, the standard was a lot less protective than it should have been."

The UW researchers charge that, "Decades of exposure to chlorpyrifos and all the political wrangling and lawsuits surrounding it might have been averted if a 1972 study had been adequately reviewed by the EPA. . . . The EPA also did not re-analyze the study data when new statistical techniques became available a few years later [in the 1980s]." *UW News* reports that if the Coulston data had been reevaluated with the newer statistical tools that became available in the '80s (as should have been done, and as the UW researchers did), "EPA's reviewers would have seen that chlorpyrifos' effect on the body's chemistry accumulated over time and that the study had not discovered the 'no observed adverse effect level' used by regulators to set safe levels of exposure." Dr. Sheppard commented, "All kinds of approvals were allowed for uses that never should have been allowed and quite well wouldn't have been allowed if the Coulston study authors had properly reported their results."

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THE CHALLENGES OF LITIGATING TO FORCE ACTION

EPA has been sued repeatedly for its allowance of chlorpyrifos use and has employed epic levels of foot dragging in responding to petitioners and to court orders. Highlights of the litigation and regulatory landscape include many fits and starts over the past two decades. Chlorpyrifos was first registered as an insecticide in 1965. After wide allowances for use during the 1970s, '80s, and '90s, EPA banned household uses of the compound (except for ant and roach baits) in 2000. Two years later, the agency reduced allowable application frequencies for a number of food crops. A decade after that, EPA created "buffer zones" around agricultural fields close to "sensitive" sites, such as schools, playing fields, parks, public sidewalks, residences, hospitals, and nursing homes.

In 2015, the Ninth Circuit Court of Appeals ordered EPA to respond to a petition by the Natural Resources Defense Council and Pesticide Action Network North America to ban all uses of chlorpyrifos. Following that, EPA proposed to revoke all food tolerances for the compound. In March of 2017, the newly installed Trump administration's EPA contravened the conclusions of its own scientists, as well as those of independent researchers, by reversing that 2015 decision to revoke food residue tolerances because of the chemical's neurotoxic impacts. In a suit brought by a coalition of labor and health organizations represented by Earthjustice, in 2018 the Ninth Circuit Court of Appeals ordered EPA to finalize its ban on chlorpyrifos. In April 2019, the Ninth Circuit gave EPA 90 days to justify a decision to allow chlorpyrifos to remain on the market. In July of that year, EPA announced it would allow continued use of the toxic pesticide.

Absent protective action by EPA, some states have taken action. Hawaii became the first state to ban chlorpyrifos in 2018. In 2019, six states (California, New York, Massachusetts, Washington, Maryland, and Vermont) sued EPA, arguing that chlorpyrifos should be banned because of the dangers of its use to people's health. Also in 2019, the New York State legislature voted to phase out and eventually banned its use. Maryland passed a limited ban in 2020.

In February of 2020, Corteva AgriScience (formerly DowDuPont), the largest manufacturer of chlorpyrifos pesticide products, announced that it would cease production of those products by the end of 2020, citing declining sales as the reason for the move—no doubt fueled by states' actions and momentum against use of the products because of their dire health consequences. The problem behind that welcome news is the difference between one company stopping production and EPA cancellation of the registration of chlorpyrifos. Continued EPA registration permits other generic manufacturers to continue to produce and sell such products.

EPA'S INSTITUTIONAL BIAS IN FAVOR OF PESTICIDES

The coauthors of the UW study note that their reanalysis points to issues of concern beyond those specific to chlorpyrifos. One is that EPA reliance on research results that have not been properly peer reviewed can endanger public health. As they write, "The original analysis, conducted by Dow-employed statisticians, did not undergo formal peer review; nevertheless, EPA cited the Coulston study as credible research and kept its reported NOAEL as a point of departure for risk assessments throughout much of the 1980s and 1990s. During that period, EPA allowed chlorpyrifos to be registered for multiple residential uses that were later cancelled to reduce potential health impacts to children and infants. Had appropriate analyses been employed in the evaluation of this study, it is likely that many of those registered uses of chlorpyrifos would not have been authorized by EPA."

Emeritus professor in the UW School of Public Health's Department of Environmental and Occupational Health Sciences, Richard Fenske, PhD notes that the reasons for the failure of EPA to review the Coulston study—when EPA began a supposedly systematic review of such older studies in 2006 by its inaugural Human Studies Review Board—are a mystery. That said, UW News reports that when EPA began that review of such human-subject studies, the chief manufacturer of chlorpyrifos products (then Dow Chemical) specifically pulled that study from the review process, according to Dr. Fenske, a member of the initial review board. "You can speculate why they did, but they formally asked the Human Studies Review Board not to review this study and so it was never reviewed."

Dr. Fenske also said, "It is a cautionary tale that data being submitted for pesticide registration may not have undergone proper review, and that could be happening today." Dr. Sheppard asserted that, minimally, studies funded by companies developing a chemical that is under review need to be opened to outside scrutiny, adding, "I'm not sure industry should be doing these studies at all. I don't think the fox should be guarding the hen house."

FARMWORKER PARENTS SUING FOR DAMAGES

Meanwhile, in central California, what promises to be a landmark series of lawsuits against Corteva is under way, spearheaded by the case *Alba Luz Calderon de Cerda and Rafael Cerda Martinez v. Corteva Inc., et al*. This first suit, brought by the parents of Rafael Cerda Calderon, Jr. on his behalf, charges that his lifelong disabilities were caused by chronic

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exposures to chlorpyrifos. The parents are suing for general damages, compensatory damages (due to Rafael, Jr.'s loss of earning capacity), medical care costs, and "punitive damages for the willful, reckless, and recklessly indifferent conduct of the Defendants" in intentionally hiding the dangers of their chlorpyrifos products from customers and the public. As with so many dangerous pesticides, absent effective federal regulation, states, cities, and other entities are taking action to protect people from this compound and, as in this case, individuals are seeking redress for harms suffered. In the face of inadequate federal and state laws and a politicized EPA, lawsuits against the manufacturers and users of pesticides may be not only a remedy for harm, but also drive the market to safer products. The $10.8 billion settlement that Monsanto proposed with plaintiffs harmed by glyphosate/Roundup is indicative of future actions. However, these court decisions occur after millions of people are exposed and harmed in ways that are not always directly traceable back to the chemical.

The farmworker case was filed in mid-September in California Superior Court, Kings County, and names not only Corteva, but also, the cities of Huron and Avenal, Woolf Farming Company, Cottonwest, LLC, John A. Kochergen Properties (successor in interest to Alex A. Kochergen Farms), and an "invisible" pesticide applicator as defendants. Plaintiffs are represented by several law firms, led by Calwell Luce diTrapano, PLLC of Charleston, West Virginia. Lead attorney Stuart Calwell reports that the firm is "in the process of reviewing around 200-plus records. We probably got 87 that look like they're provable cases." *AP News* reports that at least 50 additional plaintiffs have emerged and are in the litigation pipeline for similar harms caused by this toxic pesticide.

THUMBS UP TO CONTINUED USE

Then came the 2020 chlorpyrifos interim decision, which proposes to limit uses of chlorpyrifos in some U.S. regions "to better protect human health and the environment," according to EPA. The decision proposes: (1) "label amendments limiting application to address potential drinking water risks of concern," (2) "additional personal protection equipment and application restrictions to address potential occupational handler risks of concern," and (3) "spray drift mitigation, in combination with the use limitations and application restrictions identified to address drinking water and occupational risks, to reduce exposure to non-target organisms."

The text of EPA's decision can be accessed at *bp-dc.org/chlorpyrifosEPA*. A review of the regional application limits (in the tables in section IV of the draft decision, "Proposed Interim Registration Review Decision") shows that the proposed "limits" continue to allow "high-benefit agricultural uses," in the aggregate, on nine crops across 40 states. This is unacceptable for such a dangerous pesticide, to which people can be exposed through diet, water, landscape uses, and/or "use on public health pests, such as mosquitoes, ticks, and fire ants."

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In truth, this decision continues the Trump EPA's anti-science, anti-regulatory track record. One among many examples is that despite the endocrine disrupting effects of chlorpyrifos, this decision asserts: "There is no evidence demonstrating that chlorpyrifos potentially interacts with estrogen, androgen, or thyroid pathways."

Further, Beyond Pesticides reported in 2019 on the administration's concealment of a report showing that 1,399 endangered species are significantly threatened by chlorpyrifos (and two other organophosphate pesticides). This interim decision states, "The proposed mitigation described in this document is expected to reduce the extent of environmental exposure and may reduce risk to listed species whose range and/or critical habitat co-occur with the use of chlorpyrifos.… EPA is currently working with the National Marine Fisheries Service (NMFS) under a reinitiated *Endangered Species Act* (ESA) consultation, and NMFS plans to issue a revised biological opinion for chlorpyrifos ***in June 2022*** [emphasis by Beyond Pesticides]. The U.S. Fish and Wildlife Service (FWS) has not yet completed a biological opinion for chlorpyrifos. EPA will complete any necessary consultation with NMFS and FWS for chlorpyrifos prior to completing the chlorpyrifos registration review." Thus, vulnerable wildlife and habitat will continue to be at risk for at least another year and a half (barring any change by the Biden administration), pending a final EPA registration decision on chlorpyrifos.

Beyond Pesticides wrote in 2019, and continues to maintain, that absent effective national protections, "States should ban chlorpyrifos compounds . . . should undertake organic management on state-owned lands, and should support producers in transitioning away from chemical agriculture and to organic, regenerative, and sustainable practices.

CONCLUSION

The question remaining is whether the chlorpyrifos story will provide lessons for transforming our approach to pesticide law and regulation, especially with the viability and profitability of cost-effect organic production practices. Individual chemical bans are not the strategy for a sustainable future. The lessons from chlorpyrifos teach the urgency of shifting to management practices that eliminate all toxic pesticides, given that we have the tools to manage land and produce food without them.

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Corporate Corruption and Lies Lead to EPA Supporting Toxic Tragedy

EPA reliance on corrupt science leads to the marketing of pesticide products

JAY FELDMAN AND DEBRA SIMES

The *Midwest Center for Investigative Reporting* published a piece in early December on yet another example of the corporate malfeasance that exalts profit far above concerns for safety, health, and ecosystems. The *Midwest Center*'s investigation, "'Buy it or else': Inside Monsanto and BASF's moves to force dicamba on farmers," finds that Monsanto/Bayer and BASF, makers of the crop-damaging herbicide dicamba, engaged in a variety of deceitful, unethical, and possibly fraudulent practices to enable its use. The bottom line is that, according to records uncovered, the companies knew, before they released dicamba, about the massive damage it would cause—and then put it on the market anyway. Beyond Pesticides has reported on the corporate greed that fuels the downstream public health, environmental, and economic devastation these pesticides cause, and advocated for their removal from the market. This corporate malfeasance has embedded itself into the decision-making process at the U.S. Environmental Protection Agency (EPA), where the Office of Pesticide Programs relies on industry-generated safety data to register and regulate pesticide products whose uses result in widespread public exposure.

THE GENETICALLY ENGINEERED CROP-PESTICIDE DEPENDENT TREADMILL

Such unscrupulous and potentially illegal behavior is not confined to these companies; Bayer (which now owns Monsanto) and Syngenta (China National Chemical Corporation, known as ChemChina) are also implicated in similar actions related to other pesticides: glyphosate, and atrazine, respectively. Over the course of the past couple of decades, large agrochemical corporations have pursued not only extreme market penetration for their toxic products, but also, vertical integration that, in the case of Bayer/Monsanto, "represents a near-monopoly on the agriculture supply chain," according to Green America. Corporate ownership of the patent on genetically engineered (GE) seeds—which work only when paired with pesticides the company manufactures—not only suppresses competition, but also, with enough market share, essentially imposes near-complete reliance by farmers on one company's products. Analysts and advocates regard this as a serious threat to the global food supply, health, biodiversity, and the environment.

When EPA fails to carry out its mission to protect health and the environment by allowing use of pesticides that are known to be hazardous and not fairly and scientifically evaluated, the agrochemical landscape becomes a toxic tragedy. A bit of review of the dicamba saga will be helpful. Dicamba is a particularly problematic herbicide, given its propensity to drift, the widespread damage it causes to nontarget flora, and industry's intensive marketing of various product iterations. Added to that list are its impacts on human health: carcinogenicity, neurotoxicity, hepatic and renal damage, and developmental effects, among others. Further, it is toxic to birds, fish, and other aquatic organisms, which is especially relevant where it shows up in groundwater, as it tends to in the Pacific Northwest.

DICAMBA

Dicamba damages crops and rural communities: EPA sidelined

THE HERBICIDE WAS USED FOR DECADES ON ITS OWN to control weeds on cropland. The "modern" dicamba debacle began in 2016 when EPA approved Monsanto's dicamba "strategy" for cotton and soybeans: the dicamba formulation Xtendimax for use with seeds genetically engineered to be dicamba-tolerant. Once deployed, because of the herbicide's strong tendency to drift for significant distances, its use resulted in "millions of acres of crop damage across the Midwest and South; widespread tree death in many rural communities, state parks and nature preserves; and an unprecedented level of strife in the farming world." As reports of this extreme damage began to roll in, states began to scramble to regulate dicamba's use, absent federal efforts, to try to curb some of the devastation.

"Holdout" farmers, including organic growers, who have rejected the use of the GE-seed-plus-herbicide scheme, have been particularly vulnerable to the ravages of dicamba drift. Their complaints to neighboring farmers, whose dicamba use has compromised yield, destroyed crops, or rendered them no longer organic, are often met with indifference or anger. (As mentioned above, dicamba use is a factor in increasing tensions in some rural communities, including a murder over crop damage.) These farmers are faced, as the *Midwest Center* writes, with the choice to "get poisoned or get on board" the (GE-seed-plus-herbicide) train.

SUING THE CHEMICAL COMPANY FOR DAMAGES

Notably, as Beyond Pesticides reported in early 2020, a Missouri peach farmer that sued Bayer and BASF for damage to his trees won $265 million in compensation for the companies' "negligence in the design of their dicamba herbicides, and failure to warn farmers about the dangers of their products. . . . The jury determined that the joint venture between the two companies amounted to a conspiracy to create an 'ecological disaster' in the name of profit." An attorney for the plaintiff in that case, Billy Randles, commented, "This is the first product in American history that literally destroys the competition. . . . You buy it or else."

These realities demonstrate the perverse elegance of strategic corporate "verticality-plus-penetration." Pesticide manufacturers control supply chains, functionally force farmers into intense reliance on their products, and then use other farmers as leverage on those who resist to get them to "get with the program." Monsanto has been notorious for bankrupting small farmers who have dared to say "no" to its near-hegemony by, for example, saving seeds to plant in the following season, thus opting out of purchasing the company's GE seeds.

This Midwest Center reporting shows that executives at Monsanto, knowing full-well the potential damage of their dicamba/GE seed system, proceeded. The story reveals that Monsanto:

- released and marketed its dicamba products "knowing that dicamba would cause widespread damage to soybean and cotton crops that weren't resistant to dicamba. They used 'protection from your neighbors' [messaging] as a way to sell more of their products. In doing so, the companies ignored years of warnings from independent academics, specialty crop growers and their own employees."
- limited any testing that could have delayed or denied EPA approval of dicamba; "For years, Monsanto struggled to keep dicamba from drifting in its own tests. In regulatory tests submitted to the EPA, the company sprayed the product in locations and under weather conditions that did not mirror how farmers would actually spray it. Midway through the approval process, with the EPA paying close attention, the company decided to stop its researchers from conducting tests."
- knew of outstanding questions and concerns about dicamba's use when it submitted data for approval to regulators; "The company's own research showed dicamba mixed with other herbicides was more likely to cause damage. The company also prevented independent scientists from conducting their own tests and declined to pay for studies that would potentially give them more information about dicamba's real-world impact."
- investigated drift incidents in ways designed to "limit their liability, find other reasons for the damage, and never end with payouts to farmers."
- collaborated for years with BASF on the dicamba-tolerant seed system.
- "released seeds resistant to dicamba in 2015 and 2016 without an accompanying weed killer, knowing that off-label spraying of dicamba, which is illegal, would be 'rampant.' At the same time, BASF ramped up production of older versions of dicamba that were illegal to apply to the crops and made tens of millions of dollars selling the older versions, which were more likely to move off of where they were applied."

ROUNDUP

Monsanto pushes glyphosate/Roundup-dependent crops without EPA objection

IN 1989, MONSANTO INTRODUCED ITS ROUNDUP Ready™ scheme—GE (glyphosate-tolerant) seeds to be used with the company's existing glyphosate-based herbicide, Roundup. Glyphosate herbicides have been in heavy use in the U.S. for GE soybeans, corn, canola, alfalfa, cotton, and sorghum for more than two decades. In the mid–2000s, this profitable ploy began to hit speed bumps, as widespread resistance to glyphosate began to develop. The Bayer/Monsanto response to this resistance and the subsequent development of so-called "super weeds" was to double down, developing soybean and cotton seeds that were tolerant of both dicamba and glyphosate, and encouraging tank mixing and use of both herbicides. This tactic also became problematic: (1) this mixing increases concentrations of dicamba in the air up to nine times compared to dicamba alone, and (2) dicamba, when mixed with glyphosate, and/or when used in hot weather, is even more drift prone than the compound by itself.

CORPORATE DECEPTION ON GLYPHOSATE/ ROUNDUP SAFETY

Monsanto, with its role with dicamba and glyphosate, has been "all in" on the chemical treadmill, and is a notorious corporate "bad actor." It has spent years and a fortune on efforts to convince the public that its glyphosate products are "safe," primarily by hiding information about the herbicide's impacts, including building an image that it is a big supporter of "sustainable agriculture." On the heels of the 2015 finding by the International Agency for Research on Cancer (IARC) that glyphosate is a probable human carcinogen, the company was hit with many lawsuits for glyphosate's role in, particularly, development of non-Hodgkin lymphoma (NHL). In 2017, a judge's unsealing of two rounds of documents—dubbed the "Monsanto Papers"—made headlines because of what they showed. Emails, both internal and between the company and federal regulators, revealed "questionable research practices by the company, inappropriate ties to a top EPA official, and possible 'ghostwriting' of purportedly 'independent' research studies" that it publicly attributed to academics.

Monsanto has also attacked and discredited researchers, journalists, and others who dare to challenge the safety of its products and/or the company's "integrity." In 2019, more document releases (via Freedom of Information Act, or FOIA, requests) revealed Monsanto's "'intelligence fusion center" that monitored potential threats to the industry and spread retaliatory responses through third-party sources. Its actions included a campaign against Carey Gillam, author of *Whitewash: The Story of a Weed Killer, Cancer, and the Corruption of Science*, in which she explains the company's efforts "to cover up—through fraud, intimidation, [and] ghostwriting agency documents—the science showing that glyphosate kills humans as well as weeds."

Beyond Pesticides noted, in its review of Ms. Gillam's book, that Monsanto also spearheaded attacks on IARC Chair Aaron Blair, PhD (a celebrated former National Cancer Institute Occupational Studies Branch chief), and pressured EPA to prevent the participation of epidemiologist Peter Infante, PhD (former director of the Office of Standards Review in the Health Standards Program of the Occupational Safety and Health Administration) on a science advisory panel on the potential carcinogenicity of glyphosate. *(For more, see the article "Monsanto: Decades of Deceit" by Ms. Gillam in the Summer 2018 issue of Beyond Pesticides' journal,* Pesticides and You.*)*

The *Monsanto Papers* extended the evidence for what a previous report, The *Poison Papers*, had demonstrated: behind-the-scenes collusion between agrochemical companies (and other industry sectors) and federal regulators, a problem that escalated wildly during the Trump administration. *The Poison Papers* (*TPP*) was a trove of documents—obtained largely by author and activist Carol Van Strum (author of the classic *A Bitter Fog* on the harm caused by Agent Orange—2,4,5-T and 2,4-D—spraying in forestry management in the Northwest), and published by The Bioscience Resource Project and the Center for Media and Democracy. The documents made public a decades-long pattern of collusion between industry and regulators. *TPP* showed, in excruciating detail across more than 20,000 documents, that both entities were aware of the toxicity of many chemical products, and yet worked together to keep this information from the public and the press.

The introduction to *TPP* asserts: "Corporate concealment is not a new story. What is novel in [T]he *Poison Papers* is abundant evidence that EPA and other regulators were, often, knowing participants or even primary instigators of these cover-ups. These regulators failed to inform the public of the hazards of dioxins and other chemicals; of evidence of fraudulent independent testing; even of one instance of widespread human exposure. The papers thus reveal, in the often-incriminating words of the participants themselves, an elaborate universe of deception and deceit surrounding many pesticides and synthetic chemicals."

ATRAZINE

Syngenta's atrazine campaign: damage scientists and EPA decisionmaking

SYNGENTA CROP PROTECTION (SYNGENTA) IS ANOTHER among this crew of ethically challenged corporations; the company has gone to all kinds of lengths to protect its investment in and profits from its atrazine products. The herbicide is used primarily on corn, wheat, and sugar cane, on turf (especially golf courses and lawns), and on Christmas tree farms. It is very prone to runoff from fields (which can contaminate water supplies in the Midwest and South, primarily), and can drift through the air for hundreds of miles from target sites when applied as a spray. The compound is implicated in a variety of health problems, including cancer, endocrine disruption, neurotoxicity, and reproductive anomalies, and is especially dangerous for embryos and young children.

The Center for Media and Democracy's (CMD) *PR Watch* reported in 2012 on documents it had obtained showing that Syngenta's "PR team investigated the press and spent millions to spin news coverage and public perceptions in the face of growing concerns about potential health risks from the widely used weed killer atrazine." The company used a variety of tactics to buoy the perception and reputation of its atrazine products: it sought third parties to speak in support of the herbicide, floated glowing corporate op-ed pieces to appear under willing individuals' bylines, and directed its chief scientist to ghostwrite a book chapter that would challenge the idea of regulating atrazine by applying the Precautionary Principle. After a *New York Times* investigation and report on atrazine, that public relations team at Syngenta held a meeting in which one agenda item was "'to obtain the services of a well know (sic) investigative reporter to probe around the EPA' and, at a minimum get advice 'on what buttons to push and cages to rattle.'"

In 2013, an investigative report, "Pest Control: Syngenta's Secret Campaign to Discredit Atrazine's Critics," by *100Reporters*, a nonprofit investigative journalism group, showed that the agrochemical company "routinely paid 'third-party allies' to appear to be independent supporters, keeping a list of 130 people and groups it could recruit as experts without disclosing ties to the company." The investigating reporters used unsealed court documents in a 2004 court case originally filed by the Holiday Sanitary District in Illinois for atrazine contamination of its water system that led to class action litigation by community water systems (CWS). The court documents "reveal a corporate strategy to discredit critics and to strip plaintiffs from [a] class-action case." Ultimately, in 2012, Syngenta agreed to pay $105 million, which was intended to provide financial recoveries for costs that had been borne for decades by more than 1,887 CWSs that provide drinking water for more than one in six U.S. residents across at least 45 states.

The company took special aim at Tyrone Hayes, PhD, professor of integrative biology, University of California, Berkeley, a leading researcher on atrazine, and one of its most outspoken critics. Dr. Hayes began his atrazine research in 1997 with a study funded by Novartis Agribusiness, one of two corporations that would later form Syngenta. When he got results Novartis did not expect or want, he received backlash from the industry. Attempts were made to stall his research, and funding was withheld. It was a critical time, as EPA was close to making a final ruling on atrazine. Hermaphroditic frogs would not help the chemical company's cause. Dr. Hayes continued the research with his own funds and found more of the same results, when Syngenta offered him $2 million to continue his research "in a private setting." A committed teacher with a lab comprised of loyal students, Dr. Hayes declined the offer and proceeded with research that he knew had to remain in the public domain. With other funding secured, he replicated his work and released the results: exposure to doses of atrazine as small as 0.1 parts per billion (below allowed regulatory limits), turns tadpoles into hermaphrodites—creatures with both male and female sexual characteristics. When his work appeared in the prestigious *Proceedings of the National Academy of Sciences*, Syngenta attacked the study, starting an epic campaign against a respected scientist.

The CWS court documents show that the company conducted research into the vulnerabilities of a judge and Dr. Hayes' personal life. Syngenta's former head of communications, Sherry Duvall Ford, ranked strategies that Syngenta could use against Dr. Hayes in order of risk, according to her notes from Syngenta meetings in April 2005. One possibility: offering "to cut him in on unlimited research funds." Another: Investigate his wife. The company even commissioned a psychological profile of Dr. Hayes. In her notes taken during a 2005 meeting, Ms. Ford refers to Hayes as "paranoid schizo and narcissistic. "Syngenta commissioned a psychological profile of the scientist in hopes of boosting its

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campaign to delegitimize him and his work and derail regulatory action at EPA. Beyond Pesticides stepped up to support Dr. Hayes's work by establishing its Fund for Independent Science.

Numerous studies confirm Dr. Hayes' early findings that even minute doses of endocrine disrupting chemicals, including atrazine, can have significant effects on human health, and that the dose-response protocol used by EPA is inadequate to evaluate the effects of endocrine disruptors, which defy classical toxicology and maximum-tolerated animal testing. This corporate corruption and EPA complicity continue to this day. Several of the report's authors have been criticized by industry representatives, other scientists, and even politicians because they have become outspoken advocates for testing, regulating, and replacing endocrine disrupting compounds. Meanwhile, EPA has never fully implemented the requirements of the *Food Quality Protection Act of 1996*, which requires the agency to develop a new protocol to regulate endocrine disruptors like atrazine. The scientists, however, say they feel compelled to continue to speak out because regulatory agencies are slow to act and they are concerned about the health of people, especially infants and children, and wildlife. As Dr. Hayes said to audiences at Beyond Pesticides national conferences: "I went to Harvard on scholarships. I owe you! I did not go to school to let someone pay me off to say things that are not true."

CONCLUSION

What does one make of this litany of reports on corporate and regulatory misbehavior? The *Poison Papers*, the *Monsanto Papers*, the Midwest Center's new reporting, the *100Reporters* report, (CMD's) *PR Watch* investigation—taken together, the pattern and motive are inescapable. Agrochemical companies (and their allies, which have included regulators in federal agencies, particularly EPA and the U.S. Department of Agriculture) have been engaged, and continue to be, in devious and dangerous efforts to hide the truth about the hazards of pesticide (and other chemical) products from the public and the press. These reports from many different reporters yield ample evidence of this pattern, are the tip of the iceberg, and concerningly, cover only some of the orchestrated corporate strategies and behaviors.

The on-the-ground reality is that these actions result in widespread pesticide contamination of human bodies, those of other organisms, and vulnerable ecosystems. Such companies place greater value on their ability to sell poisons than on the harms those products do. This not only is disgraceful, but also, such actions should be the target of federal and state efforts to expose them, hold them accountable, ban their products and participation in the regulatory process, and create and enforce genuinely protective government agencies.

The onus for holding corporations accountable for their malfeasance should not rest on members of the public, and on health and environment education and advocacy groups (such as Beyond Pesticides—which, for example, recently joined a lawsuit against EPA over its decision to reapprove atrazine). Necessary change will not and has not come with campaigns and lawsuits against individual chemicals. Rather, the representative industry and resulting agency corruption must be purged in order to address a systemic problem. The transformation requires a focus on eliminating toxics in favor of ecosystem-compatible practices and products that are now available, but undermined by weak statutes, regulations, and ongoing corruption. When alternatives assessments on pesticide use proposals are fairly and accurately done, toxic pesticide use is found to be unnecessary, given the availability of alternatives. In this light, the following are overwhemingly unacceptable and unreasonable: public and worker adverse health effects; impacts on children, older people, and other vulnerable population groups; disproportionate risk to black, indigenous and people of color communities; pollinator, ecosystem and biodiversity decline; water and wildlife poisoning; agricultural and fenceline (near chemical production plants) community poisoning; and dependency on petroleum-based pesticides and synthetic fertilizers that drive the climate crisis.

Integrity at EPA must also be restored, with real, rather than "purchased" or biased science at the center, and with zealous protection of health and environment at the forefront.

Stop Corporate Corruption that Supports EPA Pesticide Decisions

Time to institute systemic change at EPA

With a new administration, it is time to end the rule of corporate deception at EPA. We can no longer rely on bad science and unscrupulous chemical manufacturers that put profits above concerns for the health of people and the environment. EPA must audit pesticide registrants for integrity to scientific process and set a moratorium on future pesticide registration until the agency can assure the public that its science is not corrupt, as it has been in the past.

Tell President Biden and Congress to clean up the corruption of science at EPA and set a moratorium on future pesticide registrations—until the agency can assure the public that the chemical manufacturers' science supporting pesticide registrations is not corrupt.

Suggested language:

Dear President Biden/Senator/Representative:

As you address the legacy of bad government left you by the Trump administration, I ask you to look at the need to clean house at EPA. Treatment of chemical companies as clients rather than regulated entities is not new at EPA, but corruption reached new highs during the Trump administration. It is time to end the rule of corporate deception at EPA. Please launch an investigation into the conduct of EPA's Office of Pesticide Programs. We can no longer rely on bad science and unscrupulous chemical manufacturers that put profits above concerns for the health of people and the environment. EPA must audit pesticide registrants for integrity to scientific process and **set a moratorium on future pesticide registrations until the agency can assure the public that the chemical manufacturers' science supporting pesticide registrations is not corrup**t, as it has been in the past.

Taken together, several investigative reports—the *Poison Papers*, the *Monsanto Papers*, the Midwest Center's reporting, the *100Reporters* report, (CMD's) PR Watch investigation—show an inescapable pattern: Agrochemical companies (and their allies, which sometimes have included regulators in federal agencies, including EPA) have been engaged, and continue to be, in devious and dangerous efforts to hide the truth about the harms of pesticide (and other chemical) products from the public and the press. These few reports from many different reporters yield ample evidence of this pattern, and concerningly, likely cover only some of the corporate strategies and behaviors afoot.

On the ground, the reality is that these actions result in widespread pesticide contamination of human bodies, those of other organisms, and vulnerable ecosystems. Such companies place greater value on their ability to sell poisons than on the harms those products cause. Such actions should be the target of federal and state efforts to expose them, hold them accountable, and create and enforce genuinely protective regulations. Instead, we have seen collusion.

The onus for holding corporations accountable for their malfeasance should not rest on harmed individuals, members of the public, and health and environment education and advocacy groups. Integrity at EPA—in short supply during the Trump administration—must be restored, with real, rather than "purchased" or biased science at the center, and with zealous protection of health and environment at the forefront. Please launch an investigation into the conduct of EPA's Office of Pesticide Programs, purge politicized science, eliminate pesticides registered with unscrupulous scientific review, and institute new protocol to stop the allowance of toxic chemicals for which there are safer alternative practices and products.

Thank you for your attention to this serious problem.

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Advancing Foundational Change

The Biden administration must tackle existential public health and environment threats with systemic change.

JAY FELDMAN AND TERRY SHISTAR, PHD

The Biden administration is faced with reversing decisions of agencies that violate the letter or spirit of laws that govern protection of health and the environment, while taking dramatic foundational steps to address existential ecological crises—climate crisis and biodiversity decline. Critical to successful strategic efforts is attention to land management practices that eliminate our reliance on petroleum-based pesticides and fertilizers and the widespread of adoption of an organic systems approach. Whether addressing agriculture or the management of parks, playing fields, rights-of-way, and residential areas, policies that allow continued reliance on synthetic toxic pesticides promote ecological imbalances that are at the heart of the escalating deterioration of ecosystems and life that depends on them.

The challenges that face us require holistic approaches to problems by addressing the underlying problems, taking on their systemic nature. This means that a focus on individual chemical bans outside the context of changes to management practices and ecological compatible products sidesteps the solution and results in a continuation of the chemical treadmill. While the problems are severe, the good news is that the solutions are available and economically viable. Those opposing change typically have a vested economic interest in maintaining dependency on outmoded and unnecessary products from which they profit.

As the President assembles a leadership team in his administration, our focus is on the critical policies that are needed to protect affected communities, with particular attention to those who suffer disproportionate risk or are in vulnerable population groups. Implementing these policies will require an integrated approach across all agencies with a mandate to meaningful and foundational changes to our social, economic, and environmental norms.

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INTEGRATING AND LEADING AGENCIES WITH A STRATEGIC VISION

The "environment" is central to President Biden's priorities: climate change, COVID-19, and the next pandemic, racial equity, and economic recovery. To solve these problems, EPA must articulate and regulate with an eye to the relationships among these and other environmental issues, with a clear vision of the changes needed to dramatically change our course, currently heading for ecological destruction.

The EPA Administrator must embrace environmentalism with a vision that adopts a dramatic transition away from hazardous chemicals and polluting practices at this perilous time.

An updated EPA must support holistic thinking, with an understanding of interrelationships in ecosystems. This requires an understanding, public education, and regulatory action on 1) the relationship between a healthy environment and a healthy economy; 2) disproportionate risk and environmental racism; 3) the importance of standing up to polluting industries; 4) the existential threats facing the country and the globe; 5) the failure of risk assessment and unrealistic risk mitigation measures that poison people and the environment, and destroy life; and 6) the need for meaningful results based on organic systems, rather than politically expedient compromises.

RELATIONSHIPS AMONG PRIORITIES AND THEIR RELATIONSHIP TO ENVIRONMENT

Environmental leadership at EPA must work hand-in-hand with economic decisions that affect sustainability—only sustainability can bring us solutions to the urgent issues of climate change, pandemics, and racial inequity. Solving problems for those at highest risk from toxic chemical-induced threats—air and water pollution, food contamination, worker exposure, and the climate crisis—provides protection for everyone. Leaving those who are vulnerable, have preexisting health conditions, or comorbidities, out of the calculation of safety, as done currently, has disproportionate impact on people of color. The data is clear that racial injustice is inextricably linked to the climate crisis, the disproportionate impact of the pandemic on black and brown essential workers, and an imbalanced economy that functions poorly in ensuring everyone an equitable share of United States' wealth and promise. Currently, all environmental decisions are screened and controlled by the White House's Office of Management and Budget, which fails to address the racial and economic disparities that are causing unimaginable harm in the interest of "economic health." We cannot achieve sustainability until we change our relationship with the "environment"—that is, the total biosphere of the Earth. EPA must be empowered to challenge the following foundational problems.

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CLIMATE CHANGE

President Biden has prioritized climate change, having appointed John Kerry to the cabinet post of "Climate Envoy." Climate change, however, is affected by, and affects, other environmental and health concerns. It is important that the Biden EPA work across agencies to ensure a coordinated approach—so that chemical industry production and use practices, individual and multiple chemicals' effects, and background sensitivities associated with elevated risk factors can be addressed in the context of their interrelationships.

The leadership provided by this holistic analysis must prioritize the solutions as a replacement for polluting practices and widespread harm. For example, toxic pesticides that kill nontarget organisms—including pollinators, soil micro- and macrofauna, predators and parasites of pests, and plants that support the agroecosystem—which are unnecessary to achieve productive, cost competitive, and profitable food production, can be eliminated in organic agriculture. EPA leadership can and must question the reasonableness of the conventional wisdom that toxic chemical dependency (including fossil fuel-based toxic pesticides and synthetic fertilizers) is acceptable, given the viability of nontoxic, organic, regenerative practices. This can be achieved under the current risk standards of most environmental laws with the appropriate leadership that takes seriously the existential threats that we face and the viability of alternatives that eliminate toxic practices. We have entered a period that requires toxic chemical and fossil fuel elimination, driven by communities across the country that understand the threats and are forcing a change in their community practices. EPA leadership must listen to local leaders and urgently change our current path.

THE WHITE HOUSE

COVID-19

EPA has a number of responsibilities that affect the pandemic and the prevention of another future pandemic. Exposure to toxic chemicals—especially those affecting the respiratory, immune, and nervous systems—makes people more susceptible to the virus. EPA's programs can recognize the threats to vulnerable population groups and tighten the reins on controlling how and when we use toxic chemicals—leading to a phase-out. In the case of disinfectants, EPA lists disinfectants that can be used to destroy the virus on surfaces, but has done so without providing information about the risks of using those disinfectants and the availability of safer materials.

RACIAL EQUITY

A blatant example of systemic racism is imbedded in risk assessments in environmental regulation. In deciding on "acceptable" risks, exposure assessments inevitably discount the impact on workers, people of color, and those with pre-existing health conditions or comorbidities. For example, EPA routinely calculates worker exposure separately from other exposures. In applying aggregate exposure assessments of pesticides, EPA does not include worker exposure. Risk assessments do not include exposures to multiple chemicals—and such exposures routinely affect fenceline communities near chemical plants, farmworkers, landscapers, and factory workers.

WORK WITH OTHER AGENCIES

Achieving the goals expressed by President Biden will require cooperation among agencies. While the Climate Envoy position is an important step forward, EPA must step up to fulfill its mandate and ensure our future and the future of following generations.

The EPA administrator must regulate and understand that it is critically and urgently important to:

- Collaborate with the U.S. Department of Agriculture (USDA) in effectuating the wide transition to organic agriculture, which eliminates the use of toxic pesticides and synthetic fertilizers. Coordinate ecological management of forests with USDA to help in fighting climate change.
- Work with the Department of the Interior (DOI) to facilitate the protection of natural areas, including National Wildlife Refuges, which serve as a carbon sink and assist in combating climate change. DOI can also assist in protecting indigenous cultures that have much wisdom to offer for protecting natural systems.
- Work with the Department of Energy to ensure that our pursuit of energy sources supports life and protects our biosphere.
- Intersect with the Food and Drug Administration (FDA) on pharmaceuticals and other toxicants in waterways, Department of Health and Human Services on public health protections, the Fish and Wildlife Service on endangered species, U.S. Geological Survey in monitoring water quality, and the National Oceanic and Atmospheric Administration in climate and marine issues.

In order to solve the problems we are facing, we must stop treating EPA and other federal agencies as silos that work on discrete and isolated problems. The body of science calls for us to act on the confluence of issues that converge to threaten human life and sustainability of the planet. EPA must lead with a holistic vision for a sustainable society and a livable future.

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MESSAGE TO PRESIDENT BIDEN AND VICE-PRESIDENT HARRIS

The U.S. Environmental Protection Agency must address cross-cutting environmental issues, with a clear vision that protects against escalating ecological destruction and ensures that our economy supports the protection of ecosystems that sustain life. Treating environmental problems as isolated threats associated with individual chemicals or practices moves us from one problem to the next with ongoing deterioration that has become insurmountable.

The past four years have taught us that EPA cannot treat the chemical industry and others in polluting industries as its clients. Instead, leadership is required to move industry to address priority issues in the aggregate and address the interconnections associated with climate, health, and biodiversity decline.

Holistic Thinking. EPA must lead with holistic thinking and an understanding of interrelationships in ecosystems—with an understanding of the relationship between a healthy environment and a healthy economy; disproportionate risk and environmental racism; the importance of standing up to polluting industries; the existential threats facing the country and the globe; the failure of risk assessment and unrealistic risk mitigation measures that poison people and the environment; and the need for meaningful results rather than politically expedient compromises.

Issue Interrelationships. The environment is central to your interrelated priorities of climate change, COVID-19, racial equity, and economic recovery. Climate change increases susceptibility to COVID-19, disproportionately affects low-income and people of color, and poses a major threat to the economy. COVID-19 affects climate emergency response, black and brown people, and the economy. Racial injustice is inextricably linked to the climate crisis, the disproportionate impact of the pandemic on essential workers, and an imbalanced economy.

Climate. Your priority of seriously confronting the climate crisis is affected by and affects other environmental and health concerns. It is important to work across agencies to ensure a coordinated approach—both because they are important in their own right and because of their relationship to climate change. Cooperation among agencies is needed to promote organic agriculture, conserve natural areas and marine ecosystems, preserve indigenous cultures, and monitor resources.

EPA must prioritize solutions to replace practices causing widespread harm. Toxic pesticides that kill nontarget organisms—including pollinators, soil micro- and macro-fauna, predators and parasites of pests, and plants that support the agroecosystem—which are unnecessary for productive, cost-competitive, and profitable food production, can be eliminated in organic agriculture. EPA leadership must thus question the reasonableness of conventional wisdom accepting toxic chemical dependency. EPA must listen to communities across the country that understand the threats and are changing their practices.

COVID-19 and Future Pandemics. Exposure to toxic chemicals—especially those affecting the respiratory, immune, and nervous systems—increases susceptibility to COVID-19. EPA lists disinfectants that can be used to destroy the virus on surfaces without information about their risks and the availability of safer materials. The agency's decisions on antimicrobial and antibiotic use in agriculture will affect a future pandemic associated with bacterial resistance.

Environmental Racism. Risk assessments incorporate a blatant example of systemic racism. In deciding on "acceptable" risks, exposure assessments inevitably discount the impact on workers, people of color, and others at risk. For example, EPA does not include workers in calculating aggregate exposure to pesticides. Risk assessments do not include exposures to multiple chemicals—which routinely affect fenceline communities, farmworkers, landscapers, and factory workers.

PESTICIDE REGULATION IN A HOLISTIC CONTEXT

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While the federal pesticide law, the *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA), is among the weakest of environmental, public health laws, EPA has a large degree of discretionary authority to reorient the agency in taking on the major issues that threaten a sustainable future.

CHALLENGE SO-CALLED "BENEFITS" OF PESTICIDES

FIFRA requires EPA to weigh risks against benefits when registering pesticides. Claimed "benefits" for toxic pesticides should be judged in comparison to organic production, which is able to produce every type of food and feed. Organic sales now exceed $55 billion per year, and USDA finds that organic producers in the U.S. produced $9.9 billion worth of organic food on 5.5 million acres in 2019. EPA assumes benefits of pesticides, rather than measuring them, and does not take into account the development of pest resistance and secondary costs associated with ecological decline (lost pollination), and cost of treating chemical-induced illness. The cost-competitive success of organic food production and nonagricultural land management practices make the case that toxic pesticides lack benefits. Even when EPA determines "acceptable" risks (rates of disease and death) with health-based standards, it falsely assumes the need for toxic chemicals in setting those allowable rates of harm.

To take on benefits successfully the agency should determine under current law the "reasonableness" of risk. If there are less toxic means of achieving the pest management goals, then the hazards associated with the pesticide are not reasonable. The agency should conduct benefits analyses. Agency analyses are filled with uncertainties related to the risks to a range of people with different exposure hazards. In this context, the agency should take a precautionary approach that treats unknown and untested effects as unacceptable.

PROTECT POLLINATORS

Agriculture relies on insect pollinators to facilitate fertilization and maintain annual crop yield. Globally, the production of crops dependent on pollinators is worth between $253 and $577 billion yearly. Yet, many agricultural pesticides are killing pollinators outright, making them more susceptible to parasites and disease, and destroying their habitat. Insects in the environmental contribute to ecological balance and ecosystem services that have financial benefit to the agricultural section. The severe decline in pollinator populations raises the alarm of insect decline, or the devastating effect of the "insect apocalypse," and the collapse of ecosystems, including birds and wildlife.

PROTECT WORKERS

Farmworkers are at greatest risk from pesticide exposure in the human population. A blatant example of systemic racism is imbedded in risk assessments in environmental regulation. In deciding on "acceptable" risks, exposure assessments inevitably discount the impact workers, people of color, and those with preexisting health conditions or comorbidities. For example, EPA routinely calculates worker exposure separately from other exposures. In applying aggregate exposure assessments of pesticides, EPA does not include worker exposure. Risk assessments do not include exposures to multiple chemicals—and such exposures routinely occur to fenceline communities, farmworkers, landscapers, and factory workers. Allowing elevated rates of harm for the population that is now called "essential workers" (farmworkers in food production and landscapers managing public land) belies a greater public understanding of the importance of adopting regulatory standards of safety that treat all people equally.

PROTECT BIODIVERSITY

Roughly a quarter of the global insect population has been wiped out since 1990, according to research published in the journal *Science*. Monarchs are near extinction and beekeepers continue to experience declines that are putting them out of business. We continue to lose mayflies, the foundation of so many food chains, and fireflies, the foundation of so many childhood summer memories, for reasons that can be prevented with leadership in regulating pesticides. It is likely that the declines we are seeing in many bird species are closely linked to insect declines. Recent research finds that three billion birds, or 29% of bird abundance, has been lost since the 1970s. Pesticides cause biodiversity loss in aquatic ecosystems as well. Amphibians are also particularly at risk. A biological evaluation by EPA in 2020 finds that the widely used weed killer glyphosate/Roundup threatens nearly every animal and plant species on the U.S. list of threatened and endangered species—93% of them, in fact. This, on top of its cancer-causing properties, supports urgent action to ban the herbicide along with others that destroy habitat and replace them with organic practices and organic compatible products.

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ELIMINATE ENDOCRINE DISRUPTING PESTICIDES

Despite the Congressional mandate in the *Food Quality Protection Act of 1996* (FQPA), EPA is not acting on endocrine disruptors linked to infertility and other reproductive disorders, diabetes, cardiovascular disease, obesity, and early puberty, as well as attention deficit hyperactivity disorder (ADHD), Parkinson's, Alzheimer's, and childhood and adult cancers. In 1998, EPA established a program to screen and test pesticides and other widespread chemical substances for endocrine disrupting effects. Despite operating for 21 years, the Endocrine Disruptor Screening Program (EDSP) has made little progress in reviewing and regulating endocrine disrupting pesticides. Now the program has stalled entirely.

To ensure appropriate follow-through, Congress gave EPA a timeline to: develop a peer-reviewed screening and testing plan with public input not later than two years after enactment (August 1998); implement screening and testing not later than three years after enactment (August 1999); and report to Congress on the findings of the screening and recommendations for additional testing and actions not later than four years after enactment (August 2000).

Despite these deadlines, EPA is stalled and ignoring its responsibility. It started a screening program (Tier 1) and reported results in 2009. According to EPA, Tier 1 Screening (which looks at high exposure chemicals) is not sufficient to implicate a chemical as an endocrine disrupting chemical. It is instead a step to define which chemicals must undergo Tier 2 testing—the only stage that can influence regulatory decision-making. It is unclear when or how EPA will move forward with Tier 2 testing, and how, if at all, any Tier 2 findings will be used to inform actual regulation.

PROTECT CHILDREN

The target of action by which many pesticides kill insects is the nervous system. It is not surprising, then, that pesticides also target the nervous system in humans. They are particularly hazardous to children, who take in greater amounts of pesticides (relative to their body weight) than adults, and whose developing organ systems are typically more sensitive to toxic exposures.

The body of evidence in the scientific literature shows that pesticide exposure can adversely affect a child's neurological, respiratory, immune, and endocrine system, even at low exposure levels. Several pesticide families, such as synthetic pyrethroids, organophosphates, and carbamates, are also known to cause or exacerbate respiratory symptoms like asthma. The American Academy of Pediatrics wrote, "Epidemiologic evidence demonstrates associations between early life exposure to pesticides and pediatric cancers, decreased cognitive function, and behavioral problems."

And yet the Trump EPA refused to ban the extremely neurotoxic insecticide chlorpyrifos—an action that was begun during the waning days of the Obama administration. Chlorpyrifos is a dangerous neurotoxicant that has dire impacts on children, making EPA's action to allow its continued use a failure of both its protective mission and ethics. Further, it is an environmental justice failure, given that risks of exposure fall disproportionately on low-income African American and Latino families, including farmworker families, who are at the greatest risk of harm. The ban on chlorpyrifos will be an important step in eliminating neurotoxic pesticides and using the opportunity to advance organic land management.

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MESSAGE TO EPA ADMINISTRATOR MICHAEL REGAN

Overhauling the pesticide regulatory system at EPA is the cornerstone of any effort to adopt crosscutting systemic change to protect against environmental racism, ecological collapse, the climate crisis, and economic stability. Here is what is needed immediately:

Challenge so-called "benefits" of pesticides. The *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA) requires EPA to weigh risks against benefits when registering pesticides. The standard for claimed "benefits" for toxic pesticides should be measured against organic production. USDA finds that organic producers in the U.S. produced $9.9 billion worth of organic food in 2019. EPA assumes benefits, rather than measuring them, and does not take into account externalities, including the cost of pest resistance, secondary costs associated with ecosystem services, and cost of treating chemical-induced illness.

Protect pollinators. Agriculture relies on insect pollinators for fertilization and annual crop productivity. Globally, the production of crops dependent on pollinators is worth between $253 and $577 billion yearly. Yet, many agricultural pesticides kill pollinators outright, make them more susceptible to parasites and disease, and destroy their habitat.

Protect workers. Farmworkers are at greatest human risk from pesticide exposure. Systemic racism is imbedded in environmental risk assessments. In deciding on "acceptable" risks, exposure assessments inevitably discount the impact workers, people of color, and those with preexisting health conditions or comorbidities. EPA routinely calculates worker exposure separately from other exposures. In applying aggregate exposure assessments of pesticides, EPA excludes worker exposure. Risk assessments do not include exposures to multiple chemicals—that routinely occur to fenceline communities, farmworkers, landscapers, and factory workers.

Protect biodiversity. Roughly a quarter of the global insect population has been wiped out since 1990. It is likely that declines in many bird species are closely linked to insect declines. Recent research finds that three billion birds, or 29% of bird abundance, have been lost since the 1970s. Pesticides cause biodiversity loss in aquatic ecosystems as well. EPA finds that the widely used weed killer glyphosate/Roundup threatens 93% of animal and plant species on the U.S. list of threatened and endangered species. This is symptomatic of land management systems that are reliant on toxic pesticides, including herbicides.

Eliminate endocrine disrupting pesticides. Despite the Congressional mandate in the *Food Quality Protection Act of 1996* (FQPA), EPA is not acting on endocrine disruptors linked to infertility and other reproductive disorders, diabetes, cardiovascular disease, obesity, and early puberty, as well as attention deficit hyperactivity disorder (ADHD), Parkinson's, Alzheimer's, and childhood and adult cancers.

Protect children. The target of action by which many pesticides kill is the nervous system. It is not surprising, then that pesticides also target the nervous system in humans. They are particularly hazardous to children, who take in greater amounts of pesticides (relative to their body weight) than adults, and whose developing organ systems are typically more sensitive to toxic exposures. And yet, EPA has refused to complete the ban of the extremely neurotoxic insecticide chlorpyrifos and other neurotoxic compounds that was begun during the Obama administration. Chlorpyrifos is a dangerous, proven neurotoxicant that has dire impacts on children, making EPA's action to allow its continued use a failure of its mission and an environmental justice issue, since the hazards fall disproportionately on low-income African American and Latino families.

Under your leadership, a revitalized EPA must take our nation in a new direction—one that requires the agency to think holistically, shift away from petroleum-based pesticides, and synthetic fertilizers, and embrace solutions that protect ecosystems that sustain all life.

PRIORITIZE ORGANIC AS THE SOLUTION

As we focus on leadership questions at USDA, issues of foundational change come into sharp focus, relating to sustainable land management, distribution of resources and access to land, food security, protection of human and ecosystem health, and climate. Ultimately, the administration must set a new tone, rejecting past performance and positions, and establish a framework that forges a new direction for agricultural and rural development programs and policies.

President Biden has talked about a framework for policy with key elements that are at the intersection of agriculture and the protection of health and the environment: (i) science-based decision-making, (ii) systemic change to solve societal problems, (iii) phase out of fossil fuel, and (iv) fight against environmental racism with disproportionate risk imposed on people of color.

To genuinely adopt these elements in a policy framework will require a dramatic change in previous agency positions. The President's *Plan for Rural America* includes meaningful assistance for family farms and other small and medium-sized farms, building a clean energy future, advancing racial equity in rural America, expanding protections for farmworkers, ensuring adequate health care in rural areas, and conserving public lands. These priorities cannot be achieved with chemical-intensive farming practices that rely on petroleum-based pesticides, fertilizers, and bioengineered crops, or continued support for corporate industrial agriculture that undermines the health of people and communities. Therefore, a systemic shift to organic agriculture will be required to meet these priorities.

Organic agriculture practices combat the climate crisis by:

- **Reducing emissions of nitrogen oxides.** Excessive use of nitrogen fertilizers in chemical-intensive agriculture is driving global nitrous oxide (N_2O) emissions higher, putting the world at greater risk of a climate catastrophe, and failure to adequately address nitrous oxide emissions has the potential to impede the ability for the world to keep warming below the 2°C target established under the Paris Climate Agreement, necessitating further cuts in other greenhouse gasses.
- **Sequestering carbon**. Regenerative organic systems, which eliminate toxic, petroleum-based pesticides that kill microbial life in the soil, sequester significant amounts of carbon from the atmosphere into on-farm soil carbon and could sequester more than 100% of current annual CO_2 emissions. *(See* Regenerative Organic Agriculture and Climate Change*, Rodale Institute [2015].)*
- **Preserving natural lands and biodiversity.** Natural forests are more effective than tree plantations in sequestering carbon. Preserving natural land increases biodiversity, which also reduces dependence on petroleum-based pesticides. Organic farms are required to "comprehensively conserve biodiversity by maintaining or improving all

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natural resources, including soil, water, wetlands, woodlands, and wildlife, as required by §205.200 of the regulations and per the §205.2 definition of Natural resources of the operation."

There is no racial justice without environmental justice, and this is particularly true in agriculture. In chemical-intensive agriculture, farmworkers are exposed to toxic agricultural chemicals. Farmworkers are predominately people of color, and dangers to them are discounted in the risk assessments used in the registration of pesticides. Materials used in organic *agriculture must not endanger humans or the environment, but non-organic foods—even those with low residues of pesticides on the end product—endanger workers and the environment*.

Organic food offers greater health benefits in certain key areas, such as total antioxidant capacity, total polyphenols, and two key flavonoids, quercetin and kaempferol—all of which are nutritionally significant. Organic dairy products contain significantly higher beneficial fatty acids, antioxidants, and vitamins. Organic food production prohibits toxic pesticide use, as distinguished from chemical-intensive agriculture and reduces existing levels of pesticides detected in children and adults. Drinking organic milk can eliminate exposure to pesticide, antibiotic, and synthetic growth hormone residues in conventional dairy products.

Organic farming is good for the economy because it is more resilient and buffered from economic risk, compared to chemical-intensive agriculture. Greater crop diversity, as required by organic standards, contributes to greater agricultural employment.

USDA has a track record of weakening organic review procedures by the National Organic Standards Board (NOSB), having ignored several NOSB recommendations, and advanced "coexistence" with the expansion of genetically engineered (GE) crops that are responsible for genetic drift, polluting non-GE and organic crops. The expansion of GE crops led to an explosion of glyphosate (Roundup) use, widespread food contamination, as well as the growth of dicamba and 2,4-D, which resulted in vast crop damage and contamination from drift throughout the Midwest. This growth in GE crops has led to insect and weed resistance to pesticides, increased reliance on toxic, petroleum-based chemicals, destruction of wildlife habitat, and economic harm to farmers. Meanwhile, USDA was in the forefront of the successful effort to squelch clear disclosure of GE ingredients in food products.

USDA has been criticized for its undermining of racial justice by the National Black Food and Justice Alliance (NBFJA), National Black Farmers Association, USDA Coalition of Minority Employees, and others. The NBFJA points to the following history:

- Routine denial of loans to Black farmers that were easily obtained by white farmers and decreased the overall dollars loaned to Black farmers;

- Failure to take discrimination complaints seriously;
- Foreclosure of Black farmers who had pending discrimination complaints;
- Failure to adequately compensate Black farmers with valid claims;
- Wrongfully forcing out Shirley Sherrod, the former head of USDA rural development in Georgia and a highly respected civil rights leader;
- Prioritizing the profits of the poultry industry over the health and safety of working people and families; and
- Collusion in the distortion of data regarding race, farming, and land.

USDA must distance itself from its historical relationship with conventional, chemical-intensive agribusiness and the dependency on industrial and factory farming operations that it pushes. Embracing family farmers and organic production practices is essential to confronting the climate crisis and ensuring a sustainable future.

MESSAGE TO SECRETARY OF AGRICULTURE TOM VILSACK

It is critical that USDA open a dialogue on the issues critical to the future health of our agricultural system, the people who labor in it, and the environment in which it operates.

President Biden has set an important framework in which to make transformational changes in confronting existential crises that directly intersect with agriculture. Key elements of the framework that intersect with the protection of health and the environment (including agriculture) are: (i) science-based decision-making, (ii) systemic change to solve societal problems, (iii) phaseout of fossil fuel, and (iv) fight against environmental racism with disproportionate risk imposed on people of color.

Within this framework, the overall policy priorities of the President include addressing the climate crisis, racial equity, COVID-19, and economic recovery. His "Plan for Rural America" includes helping family farms and other small and medium-sized farms, building a clean energy future, advancing racial equity in rural America, expanding protections for farmworkers, ensuring adequate health care in rural areas, and conserving public lands. These priorities cannot be achieved with chemical-intensive farming practices that rely on petroleum-based pesticides, fertilizers, and bioengineered crops, or continued support for corporate industrial agriculture that undermines the health of people and communities. Therefore, a systemic shift to organic agriculture will be required to meet these priorities by:

- **Reducing emissions of nitrogen oxides.** Failure to adequately address nitrous oxide emissions may impede the ability for the world to keep warming below the 2°C target established under the Paris Climate Agreement.
- **Sequestering carbon.** Regenerative organic systems sequester significant amounts of carbon from the atmosphere into soil carbon.
- **Preserving natural lands and biodiversity.** Natural forests help sequester carbon and reduce dependence on petroleum-based pesticides.

You are certainly aware that there have been points of disagreements with policy positions, relating to action and inaction on critical issues. There is significant concern about the weakening of organic review authority of the National Organic Standards Board (NOSB), ignoring NOSB recommendations to strengthen organic integrity, while promoting "coexistence" with the expansion of genetically engineered (GE) crops that are responsible for genetic drift, polluting non-GE and organic crops. The expansion of herbicide-tolerant GE crops has led to an explosion of glyphosate (Roundup) use, widespread food contamination, as well as the growth of alternative weed killers dicamba and 2,4-D, whose use resulted in vast crop damage and contamination from drift throughout the Midwest. This growth in GE crops has led to insect and weed resistance to pesticides, increased reliance on toxic, petroleum-based chemicals, destruction of wildlife habitat, and economic harm to farmers.

This is the mandate of the Biden administration: Think big and take on structural problems with systemic changes. In this context, USDA is needed to urgently address the existential threats to health, environment, racial equity, and economic security associated with current agricultural policy and practices.

URGENT NEED FOR A JOINT INTERAGENCY STRATEGY TO COMBAT ANTIBIOTIC-RESISTANT BACTERIA

Now that we have learned what a pandemic looks and feels like, with the astounding levels of infection, hospitalization, and death from COVID-19, we must take serious steps to prevent another pandemic on the horizon—this one tied to bacterial resistance to antibiotics. The use of antibiotics in agriculture is contributing to a "looming potential pandemic" worldwide, resulting from a "rise in multidrug-resistant bacterial infections that are undetected, underdiagnosed, and increasingly untreatable, [which] threatens the health of people in the USA and globally," according *The Lancet*, a prestigious medical journal, in September, 2020. The World Health Organization has declared that "AMR [antimicrobial resistance] is one of the ten top global public health threats facing humanity." The primary contributors to AMR identified in the scientific literature are uses in agriculture and overuse in medicine.

MANAGEMENT PRACTICES LEAD TO UNCONTROLLED INFECTIONS

Antibiotics are used across chemical-intensive agriculture, both crop and livestock production. In chemical-intensive, or conventional, dairy and livestock production, they are used widely as additives to animal feed to ward off any potential infections and to promote unnaturally rapid growth (the latter of which translates to higher profits), rather than being used to treat bacterial infections (although that does happen and products from treated animals can go to market with residues). Both of these objectives compensate for the overcrowded and unsanitary conditions of concentrated animal feeding operations (CAFOs). Use of antibiotics is prohibited in all certified organic production. Although the standards of the National Organic Program require that sick animals be treated, meat and other products from such animals cannot be sold with the Certified Organic label. Organic has banned antibiotics in crop production, while its uses continue in conventional fruit production, some vegetables, and citrus (grapefruits, oranges and tangerines).

An FDA (Food and Drug Administration) ban on the use of antibiotics as growth promoters in livestock, which went into effect on January 1, 2017, was confounded later that year by USDA's (U.S. Department of Agriculture) rejection of World Health Organization guidance on limiting antibiotic use in animal feed. USDA asserted that treating, controlling, and preventing" disease under veterinary supervision constitutes "appropriate use"—undercutting the ban on antibiotics for growth promotion because, when used in feed for disease prevention, antibiotics also promote growth.

In addition to direct ingestion of antibiotic residues, resistant bacteria move from farms to families, through the environment to the human population by "horizontal gene transfer." Beyond the threat from antibiotic-resistant infections, the ability of antibiotics to disturb or kill the gut microbiota in humans can lead to or exacerbate autoimmune and other 21st century diseases, including diabetes, obesity, food allergies, heart disease, cancer, asthma, autism, irritable bowel syndrome, multiple sclerosis, rheumatoid arthritis, celiac disease, inflammatory bowel disease, and more.

The authors of *The Lancet* article indicate that the AMR

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phenomenon can exacerbate COVID-19 risks. They observe that, across five countries, COVID-19 diagnoses are associated with bacterial infections (with 3.5% diagnosed concurrently and 14.3% post-COVID-19). The prevalence is higher in patients who require intensive care. They note that, "72% of COVID-19 patients received antibiotics even when not clinically indicated, which can promote AMR." The authors note: "AMR might worsen under COVID-19 due to the overuse of antibiotics in humans, continuing misuse in agriculture, and the dearth of antimicrobials in the development pipeline."

In 2015, the White House released a comprehensive action plan to curtail antibiotic misuse and accelerate new antimicrobials and vaccines—the National Action Plan for Combating Antibiotic-Resistant Bacteria. Implementation has been uneven and, at times, contradictory. The 2017 FDA ban on use of antibiotics as growth promoters was undercut that same year when USDA, as indicated above, rejected the World Health Organization's guidance to limit antibiotic use in livestock feed. At the same time, there have been unprecedented nationwide budget cuts to hospital-based AMR programs. Ignoring the looming pandemic, in 2019, EPA approved an expansion of medically important antibiotics such as streptomycin and oxytetracycline as pesticides to increase crop yields, and the USDA removed federal oversight of meat inspection at pork processing plants.

Failing to confront AMR undermines decades of advances in medicine and public health. The COVID-19 pandemic should serve as a wake-up call that progress on the national action plan is critical for public health.

MESSAGE TO PRESIDENT BIDEN AND VICE-PRESIDENT HARRIS

Urgent action is needed to prevent the next pandemic related to bacterial resistance. Now that we have learned what a pandemic looks and feels like with the astounding levels of infection, hospitalization, and death from COVID-19, we must take serious steps to prevent another pandemic on the horizon.

The use of antibiotics in agriculture is contributing to a "looming potential pandemic" worldwide, resulting from a "rise in multidrug-resistant bacterial infections that are undetected, underdiagnosed, and increasingly untreatable, [which] threatens the health of people in the USA and globally," according *The Lancet*, a prestigious medical journal, in September, 2020. The World Health Organization (WHO) has declared that "AMR [antimicrobial resistance] is one of the top 10 global public health threats facing humanity." The primary contributors to AMR identified in the scientific literature are uses in agriculture and overuse in medicine.

The misuse of antibiotics in agriculture includes antibiotics used to control certain bacterial diseases in plant agriculture (especially oxytetracycline and streptomycin). While crop uses are important contributors to breeding bacterial resistance, they are small compared to their uses in livestock production. Antibiotics are used largely as additives to animal feed to ward off any potential infections and to promote unnaturally rapid growth, rather than being used to treat bacterial infections (although that does happen and products from treated animals can go to market with residues). Both of these objectives compensate for the overcrowded and unsanitary conditions of concentrated animal feeding operations (CAFOs), which scientists believe are contributing to the next pandemic.

Although the standards of the National Organic Program require that sick animals be treated, meat and other products from such animals cannot be sold with the Certified Organic label. Organic has banned antibiotics in crop production, while its uses continue in conventional fruit production, some vegetables, and citrus (grapefruits, oranges and tangerines).

In 2015, the White House released a comprehensive action plan to curtail antibiotic misuse and accelerate new antimicrobials and vaccines—the National Action Plan for Combating Antibiotic-Resistant Bacteria. Implementation has been uneven and, at times, contradictory. In 2017, the U.S. Food and Drug Administration (FDA) banned use of antibiotics as growth promoters in livestock, but the same year, the U.S. Department of Agriculture (USDA) rejected WHO's guidance to limit antibiotic use in livestock feed. There have been unprecedented nationwide budget cuts to hospital-based AMR programs. In 2019, the U.S. Environmental Protection Agency approved expansion of medically important antibiotics such as streptomycin and oxytetracycline as pesticides to increase crop yields, and USDA removed federal oversight of meat inspection at pork processing plants. Failing to confront AMR undermines decades of advances in medicine and public health. The COVID-19 pandemic should serve as a wake-up call that progress on the national action plan is critical for public health.

Urgent action is needed to implement the *National Action Plan for Combating Antibiotic-Resistant Bacteria* through the coordination of federal agencies, including EPA, USDA, and FDA.

Keeping Organic Strong

Paper and Plastic Challenge Organic Values and Principles

Beyond Pesticides participates in the public standard setting process.

TERRY SHISTAR, PHD AND JAY FELDMAN

FROM THE EDITOR

The transition to organic land management as a solution to looming environmental and public health threats could not be more urgent. As a part of the group that drafted the *Organic Foods Production Act* (OFPA), and having served on the National Organic Standards Board (NOSB), which was created by OFPA, Beyond Pesticides believes in the importance of public engagement in organic policy making and standard setting. To that end, OFPA established the NOSB as a stakeholder board to advise the Secretary of Agriculture on all aspects of the National Organic Program (NOP), and determine which synthetic substances are allowed in organic production and handling. At twice-a-year public meetings, the board convenes to address issues that are critical to organic integrity, evaluate standards and materials, and issue recommendations that ultimately determine whether those seeking out organic food will trust the USDA organic label and help to grow the organic market. The Spring and Fall 2020 NOSB meetings were held virtually, following a comment period during which the public could submit comments on NOSB proposals. Beyond Pesticides submitted comments on all the proposals, and those comments are posted on our "Keeping Organic Strong" webpage (*bp-dc.org/kos*). We chose to use our comment time during the online meeting to focus on big picture issues that are critical to organic serving as a long-term solution to the devastation caused by chemical-intensive agriculture. We feel compelled in this piece to review the vision of organic, the common ground that is the foundation of a holistic system of soil and plant management in the context of the natural world and all that offers us in sustaining life. We do this to reinforce with the NOSB and the NOP at USDA, the foundational basis of our comments to the board.

Everywhere we turn, we see signs of ecological collapse—wildfires, the insect apocalypse, crashing populations of marine organisms, organisms large and small entangled in plastic, more and more species at risk, rising global temperatures, unusual weather patterns, horrific storms, and pandemics. As an organization focused on one of the most blatant examples of environmental abuse—the dispersal of toxic chemicals across the landscape—Beyond Pesticides, since its formation, has looked to organic land management, agricultural and nonagricultural, as a solution. In this context, we analyze practices and materials that can be harmful to the environment and people. So, it is not surprising that we need to look at the use of plastics and paper in organic production.

From its very beginnings, the organic sector has been driven by an alliance of farmers and consumers who defined organic standards as a holistic approach to protecting health and the environment, with a deep conviction that food production could operate in sync with nature and be mindful of its interrelationship with the natural world—protecting and enhancing the quality of air, water, land, and food. Organic is not just an alternative for people seeking better food—though it is that—or a more profitable way of farming—though we hope it is that, too. It is a path to prevent total ecological collapse. We constantly return to the foundations of organic for inspiration and guidance. When we comment

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on organic policy and standards, we are not interested in what is simply *less harmful*. In fact, because we are faced with an urgency to prevent ecological disaster and collapse, it becomes increasingly important that the organic agriculture sector lead the way in modeling a truly sustainable relationship with the environment. This requires an ongoing assessment of practices and materials (products) that are allowed and prohibited in organic systems through a public process of stakeholders in the organic community—the National Organic Standards Board (NOSB)—who adhere to the standards in the *Organic Foods Production Act* (OFPA).

In contrast to the reductionism of "conventional" chemical-intensive agriculture, the origins of organic agriculture are in holistic and ecological thinking. Historically, perhaps the most important principle of organic production is the "Law of Return," which, together with the foundational philosophy "Feed the soil, not the plant" and the promotion of biodiversity, provide the ecological basis for organic production.[1] Together these three principles describe a production system that mimics natural systems.

The Law of Return. In an organic system, residues are returned to the soil by tillage, composting, or mulching. While most organic growers depend on some off-site inputs, most of the fertility in a soil-based system comes from practices that recycle organic matter produced on-site. The cycling of organic matter and on-site production of nutrients—as from nitrogen-fixing bacteria and microorganisms that make nutrients in native mineral soil fractions available to plants—is essential to organic production. The Law of Return is not about feeding plants, but about conserving the biodiversity of the soil-plant-animal ecological community.

The Law of Return says that we must return to the soil what we take from the soil. Non-crop organic matter is returned directly or through composting plant materials or manures. To the extent that the cash crop removes nutrients, they must be replaced by cover crops, crop rotation, or additions of off-site materials, when necessary.

Feed the soil, not the plant. The dictum to "Feed the soil, not the plant" reminds us that the soil is a living super-organism that supports plant life as part of an ecological community. We do not feed soil organisms in isolation, to have them process nutrients for crop plants; we feed the soil to support a healthy soil ecology, which is the basis of terrestrial life.

Biodiversity. Finally, biological diversity is important to the health of natural ecosystems and agroecosystems. Biodiversity promotes ecological balance, which protects farms from outbreaks of damaging insects and disease. It supports the health of the soil through the progression of the seasons and stresses associated with weather and farming. It supports our health by offering a diversity of foods. Ultimately, holistically

healthy, truly organic, farms produce healthy plants that require far fewer applications of insecticides and fungicides (even if approved for organic production).

The definition of "organic production" in the organic regulations requires the conservation of biodiversity. As stated in the National Organic Program (NOP) Guidance on Natural Resources and Biodiversity Conservation (NOP 5020),

> The preamble to the final rule establishing the NOP explained, "[t]he use of 'conserve' [in the definition of organic production] establishes that the producer must *initiate practices to support biodiversity* ***and*** *avoid, to the extent practicable, any activities that would diminish it.* Compliance with the requirement to conserve biodiversity requires that a producer incorporate practices in his or her organic system plan that are beneficial to biodiversity on his or her operation." (76 FR 80563) *[Emphasis added.]*

Thus, it is not enough to say one is *not diminishing* soil and plant biodiversity–organic practitioners must take active steps to *support* biodiversity. On an organic farm, many practices support biodiversity–from crop rotations to interplanting to devoting space to hedgerows and other nonproductive uses.

At the time of the passage of the OFPA, the organic community's characterization of soil as alive was viewed with amusement by the "conventional" agriculture experts, who saw soil as a structure for supporting plants, while farmers poured on synthetic nutrients–and the poisons that had become necessary to protect the plants growing without the protection of their ecological community. Interestingly, organic producers at that time compared conventional agriculture to hydroponics.

A quote from the *Omnivore's Dilemma* (2006) by Michael Pollan can help give us some perspective on the importance of organic as envisioned by the pioneers of the practices and the drafters of OFPA:

> To reduce such a vast biological complexity to NPK represented the scientific method at its reductionist worst. Complex qualities are reduced to simple quantities; biology gives way to chemistry. As [Sir Albert] Howard was not the first to point out, that method can only deal with one or two variables at a time. The problem is that once science has reduced a complex phenomenon to a couple of variables, however important they may be, the natural tendency is to overlook everything else, to assume that what you can measure is all there is, or at least all that really matters. When we mistake what we can know for all there is to know, a healthy appreciation of one's ignorance in the face of a mystery like soil fertility gives way to the hubris that we can treat nature as a machine.

Newspaper and Other Recycled Paper

When OFPA was passed, and when the first NOSB worked on the first rule, organic growers saw newspapers as a natural, or nearly natural, solution to difficult mulching situations. In those cases, newspaper or other repurposed paper could be combined with other natural mulches to provide a more impermeable layer between plants—a layer that would decompose, adding organic matter to the soil, thus enhancing soil biological activity. It was also seen as recycling plant-based material in order to return nutrients to the land, thus minimizing the use of non-renewable resources. The content of newspaper and paper generally has changed over time.

When newspaper was first evaluated for the National List of Allowed and Prohibited Substances in 1995, it was seen as basically wood pulp with additives. The additives in black ink were considered to be mostly innocuous, while colored inks and glosses were prohibited because of the hazards they posed. The listing of recycled paper was a fulfillment of the value that organic agriculture should "recycle materials of plant and animal origin in order to return nutrients to the land, thus minimizing the use of non-renewable resources."

Now, fast-forward to NOP's most recent technical review (TR) on newspaper and other recycled paper in 2017. Although being mostly composed of cellulose, starch, and lignin, the TR finds:[2]

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Modern paper products also use a wide variety of synthetic polymers and co-polymers that change the functionality and performance of the paper compared with simple cellulose-starch blends. Aluminum foil and paraffin waxes are added to paper and paperboard used in food packaging. Newspaper and other printed matter have inks, dyes and toner (a solid powder used for electrostatic or electrophoretic printing). Most ink in newsprint and office paper is black, but colored inks and dyes are used on various printed material and packaging. With the advent of color printing processes, more newspapers and office paper applications involve colored ink. More printing is done with colored toner as well. Some papers do not use inks or toner for printing. Thermal paper changes color when heat is applied. The prevalent reactant acid used in thermal paper is bisphenol A (BPA). BPA is also used in flyers, magazines, newspapers, napkins, paper towels, toilet paper and paper cups.

No longer can paper be regarded as "basically wood pulp." In fact, the paper produced with polymers, which may persist after the degradation of the cellulose and lignin from wood pulp, are microplastics and present a range of environmental and public health hazards. Scientists are increasingly concerned about the impacts of microplastics—plastic fragments less than 5mm—on a wide range of organisms. Although concerns were first raised about microplastics in the marine environment, impacts on terrestrial organisms are increasingly documented. Microplastics can cause harmful effects to humans and other organisms through physical entanglement and physical impacts of ingestion. They also act as carriers of toxic chemicals that are adsorbed to their surface.

More fundamental than the issue of balancing resource recovery, by keeping newspaper out of the waste stream, against potential soil contamination are the issues of whether these uses of paper meet OFPA criteria: Are these uses of paper "necessary to the production or handling of the agricultural product because of the unavailability of wholly natural substitute products"? Are they "consistent with organic farming and handling"?

Beyond Pesticides position: As every technical review and NOSB review has stated, there are many natural materials that can be used as mulch. In addition, weed control alternatives include "cultivation, living mulches, hand weeding, flame weeding, crop rotation, and biological control of weeds." For the use of newspaper or other recycled paper to meet the criterion of necessity—as opposed to convenience—it must be required not only that other sources of mulching materials are unavailable, but also that other means of weed control are unavailable.

Plastic in Organic Production

Biodegradable biobased mulch film (BBMF) has been allowed in organic production since 2014, but no products meeting the requirements set by the NOSB are produced. As stated by NOP, BBMF must not contain any non-biobased synthetic polymer feedstocks. At its Fall meeting, the NOSB issued a discussion document that raises the possibility of loosening these requirements (annotation). BBMF results in bits of microplastic that are not fully degraded.

Although microplastics in soil have been less studied, presumably, microplastics in soil make their way in runoff to surface water. Agricultural soils may receive microplastics from sludge/compost fertilization, plastic mulches, and wastewater irrigation.[3]

Microplastics can cause harmful effects to humans and other organisms through physical entanglement and physical impacts of ingestion. They also act as carriers of toxic chemicals that are adsorbed to their surface. Some studies on fish have shown that microplastics and their associated toxic chemicals bioaccumulate, resulting in intestinal damage and changes in metabolism.[4] Soil organisms and edible plants have been shown to ingest microplastic particles.[5] Earthworms can move microplastics through the soil, and microplastics can move through the food chain to human food.[6] Microplastics can have a wide range of negative impacts on the soil, which are only beginning to be studied, but include reduction in growth and reproduction of soil microfauna.[7] When looking at the impact of microplastics, it is important to include the impact of associated substances. As noted above, they can carry toxic chemicals. A review by Zhu et al. cites several studies showing, "[M]icroplastics can serve as hotspots of gene exchange between phylogenetically different microorganisms by introducing additional surface, thus having a potential to increase the spread of ARGs [antibiotic resistance genes] and antibiotic resistant pathogens in water and sediments." [8]

Biodegradable biobased mulch film (BBMF) was approved by the NOSB for use in organic production in October 2012, and the listing was finalized September 30, 2014 as:

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(iii) Biodegradable biobased mulch film as defined in §205.2. Must be produced without organisms or feedstock derived from excluded methods [e.g., genetic engineering].

The NOP also adopted a definition in §205.2 of the regulations:

Biodegradable biobased mulch film. A synthetic mulch film that meets the following criteria:

(1) Meets the compostability specifications of one of the following standards: ASTM D6400, ASTM D6868, EN 13432, EN 14995, or ISO 17088 (all incorporated by reference; see §205.3);

(2) Demonstrates at least 90% biodegradation absolute or relative to microcrystalline cellulose in less than two years, in soil, according to one of the following test methods: ISO 17556 or ASTM D5988 (both incorporated by reference; see §205.3); and

(3) Must be biobased with content determined using ASTM D6866 (incorporated by reference; see §205.3).

While BBMF was supported enthusiastically by those who saw an opportunity to have the benefits of traditional plastic mulch without the wasteful and labor-intensive practice of carting it off to the landfill at the end of every growing season, others (including Beyond Pesticides) warned that the available products were "not ready for prime time." As predicted, the Organic Materials Research Institute (OMRI) soon announced that no products met the criteria in the National List—that is, 100% biobased and biodegradable. Before long, we were seeing declarations by OMRI, NOP, and the newer members of the NOSB that "there was confusion among Material Review Organizations (MROs) and certification agencies about how much of the feedstocks must be biobased." This so-called confusion existed in spite of clarity from the NOSB in deliberations and listing and despite clarity on the part of NOP in its clarifying memo[9] that the BBMF approved by the NOSB is 100% biobased.

BBMFs are not removed from the field by the grower. Instead, they are tilled into the soil. The tillage process purposefully creates microplastics, with the intention that the action of soil organisms will degrade these small particles. However, as reported in OMRI's 2016 Supplemental Technical Review (STR),[10] many growers report that fragments persist in the soil. OMRI reports that research on the eventual fate of biodegradable mulch films is ongoing. There is, nevertheless, research reported by OMRI indicating that the BBMFs do not completely degrade and may degrade more slowly when tilled under the surface, that they contain components that may be hazardous, and particles may adsorb persistent toxicants.

Beyond Pesticides position: Synthetic mulches should not replace natural mulches like hay, straw, and wood chips. The annotation of BBMF should not loosen restrictions on the bioplastic film.

Natural organic mulches should be the norm in organic production. The use of natural organic materials in compost and mulch is foundational to organic. In 2001, the NOSB[11] gave this definition:

> Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. These goals are met, where possible, through the use of cultural, biological, and mechanical methods, as opposed to using synthetic materials to fulfill specific functions within the system.

The NOSB went on to say that, among other things, an organic production system is designed to: "optimize soil biological activity;" "utilize production methods and breeds or varieties that are well adapted to the region;" "recycle materials of plant and animal origin in order to return nutrients to the land, thus minimizing the use of nonrenewable resources;" and "minimize pollution of soil, water, and air." The use of natural mulches—including cover crops—contributes to all of these values.

Organic production systems are also intended to mimic natural ecosystems. In natural systems, plants are fed by the action of soil organisms breaking down plant residues and excreting substances that are plant nutrients. Natural mulches provide a steady diet of organic matter for those soil organisms. This function is one way that we can judge the compatibility of synthetic mulches with organic values.

Virgin Paper, Paper Production Aids

In August of 2018, the NOSB received a petition to add chain paper pots to the National List for growing and transplanting plants. This petition introduced a number of new issues for consideration:

- The use is not for mulching or composting, but as a pot that would be placed in the ground along with the transplant.
- Although paper pots are not necessary, the chain paper pot system allows transplanting in a relatively low-tech process (without motorized propulsion) that saves the grower much tedious work.
- The paper, as petitioned, contains synthetic ingredients that are not on the National List, but which do occur in recycled paper that is currently allowed.
- The paper is not recycled, but is virgin paper, produced from unbleached Kraft pulp and adhesives. Non-paper synthetic fibers have been used up to 15% in the paper pots, but the manufacturer has proposed that these fibers be replaced by a natural hemp fiber.
- Some of the ingredients may not be biodegradable.
- The Crops Subcommittee also considered expanding the listing to other uses of paper.

From an environmental perspective, the most significant aspect of the paper pots petition is the use of virgin paper. Using recycled paper as a farm input does add a number of synthetic chemicals—not all known—to the farm. However, the use of virgin paper has far-reaching environmental impacts. As summarized by the 2019 TR,[12]

> The environmental impacts of manufacturing virgin paper are considered to be significantly greater than recycling paper. Harvesting trees to make virgin pulp and paper predictably results in soil erosion and water sedimentation through road-building activity, exposure of bare soil, and accelerated water runoff. While forestry best management practices (BMPs) may mitigate these effects, BMPs are not always implemented and there are still environmental quality concerns that have not been addressed by BMPs. Reduction of forest disturbance by recycling is seen as an environmental benefit. One ton of virgin kraft paper requires 4.4 tons of trees to produce; the same amount of recycled kraft paper requires 1.4 tons of recovered paper to produce.
>
> The ability of the forest to sequester carbon is curtailed by harvest. Additionally, recycling waste paper consistently uses less energy and results in fewer greenhouse gas emissions compared with landfilling or incinerating it. Agricultural by-product sources of pulp fiber can mitigate the adverse impacts of the reliance on wood from forests. However, the workers who are making the paper pots are more likely to be exposed to chemicals that have adverse health effects than the farmers and farmworkers using the paper pots or those who eat the food grown from the transplants.
>
> The harvest of trees results in the loss of soil and water-holding capacity in forests and reduces atmospheric carbon sequestration. Biomass cultivation can result in potential loss of biodiversity, soil carbon depletion, increased soil erosion, deforestation, and increased greenhouse gas emissions."

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Beyond Pesticides position: We agree with the decision of the NOSB to send the decision on paper pots back to subcommittee to craft specific language that does not allow paper materials that contain hazardous synthetics or introduce other environmental hazards.

Traditional Plastic for Ground Cover and Mulch

By the time OFPA was passed and the first National List was promulgated, plastic mulch was so routinely used that it was approved unanimously by the NOSB. Nevertheless, some misgivings are reflected in the language of OFPA, prohibiting the use of plastic mulches "unless such mulches are removed at the end of each growing or harvest season." The regulations also prohibit PVC plastic as mulch. Testimony at NOSB meetings indicates that this language is understood by many, but not all, certifiers to allow the continuous use of plastic mulch in perennial crops, such as fruit trees because the "growing season" is continuous. Those using plastic mulch in annual crops report taking truckloads of mulch to the landfill at the end of the growing season.

Does plastic mulch meet OFPA criteria? OFPA requires that a synthetic material on the National List meet three criteria:

1. It is not harmful to human health or the environment;
2. It is necessary to the production or handling of the agricultural product because of the unavailability of wholly natural substitute products; and
3. It is consistent with organic farming and handling.

The NOSB's 2015 sunset review of plastic mulch looked at these criteria in greater depth than before. With regard to impacts on human health and the environment, the NOSB said:

- Polyethylene (PE) is usually derived from either modifying natural gas (a methane, ethane, propane mix) or from the catalytic cracking of crude oil into gasoline, though it may be made from biological sources.
- Use of plastic mulch leads to environmental contamination because used plastic gets taken to landfills, and pieces are left behind on fields.

With regard to the need for plastic mulch "because of the unavailability of wholly natural substitute products," the NOSB and technical reviews have pointed out alternatives. Natural alternatives are organic mulches and living mulches. Alternative practices that could be used include: for weed control, tillage and other mulches; for soil warming, planting adapted plants.

The NOSB and technical reviews have also pointed out reasons that plastic mulch is not compatible with organic farming:

- Solarization kills microorganisms.
- Loss of water: In one season, the loss of water was 2-4 times higher and the loss of soil sediment was three times higher in plots where PE mulch was used compared to those where hairy vetch residues were used.
- The substitution of plastic for natural mulches reduces inputs of organic matter.

Beyond Pesticides position: Organic is a process of continuous improvement and we are advancing practices and materials that move away from plastic in production systems.

Conclusion

Organic mulches have always been a central aspect of organic production. The Rodale *Encyclopedia of Organic Gardening*, for example, begins its long entry on "mulch" with this: "A layer of material, preferably organic material, that is placed on the soil surface to conserve moisture, hold down weeds, and ultimately improve soil structure and fertility. As with composting, mulching is a basic practice in the organic method; it is a practice which nature employs constantly, that of always covering a bare soil."[13]

Reliance on synthetic mulches for functions that can be performed by organic mulch is not compatible with organic production. In addition, more is known about the hazards of the paper and plastic mulch materials that are currently available. If there are necessary functions of synthetic mulches that cannot be supplied by natural mulches, then the entries for paper and plastic mulches should be annotated to limit the synthetic mulches to those uses.

This discussion has not included the use of plastic in packaging of organic products, which is a large issue that the NOSB should also address. Much of the plastic used in packaging ends up in the environment, so the environmental issues discussed above are also relevant. In addition, toxic chemicals may migrate from the packaging into food, and there is a resource conservation issue since plastics are generally sourced from petroleum.

NOTES

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3 Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology, 102*(6), pp.741-749.

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5 Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology, 102*(6), pp.741-749.

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10 OMRI, 2016. TR Biodegradable Biobased Mulch Films.

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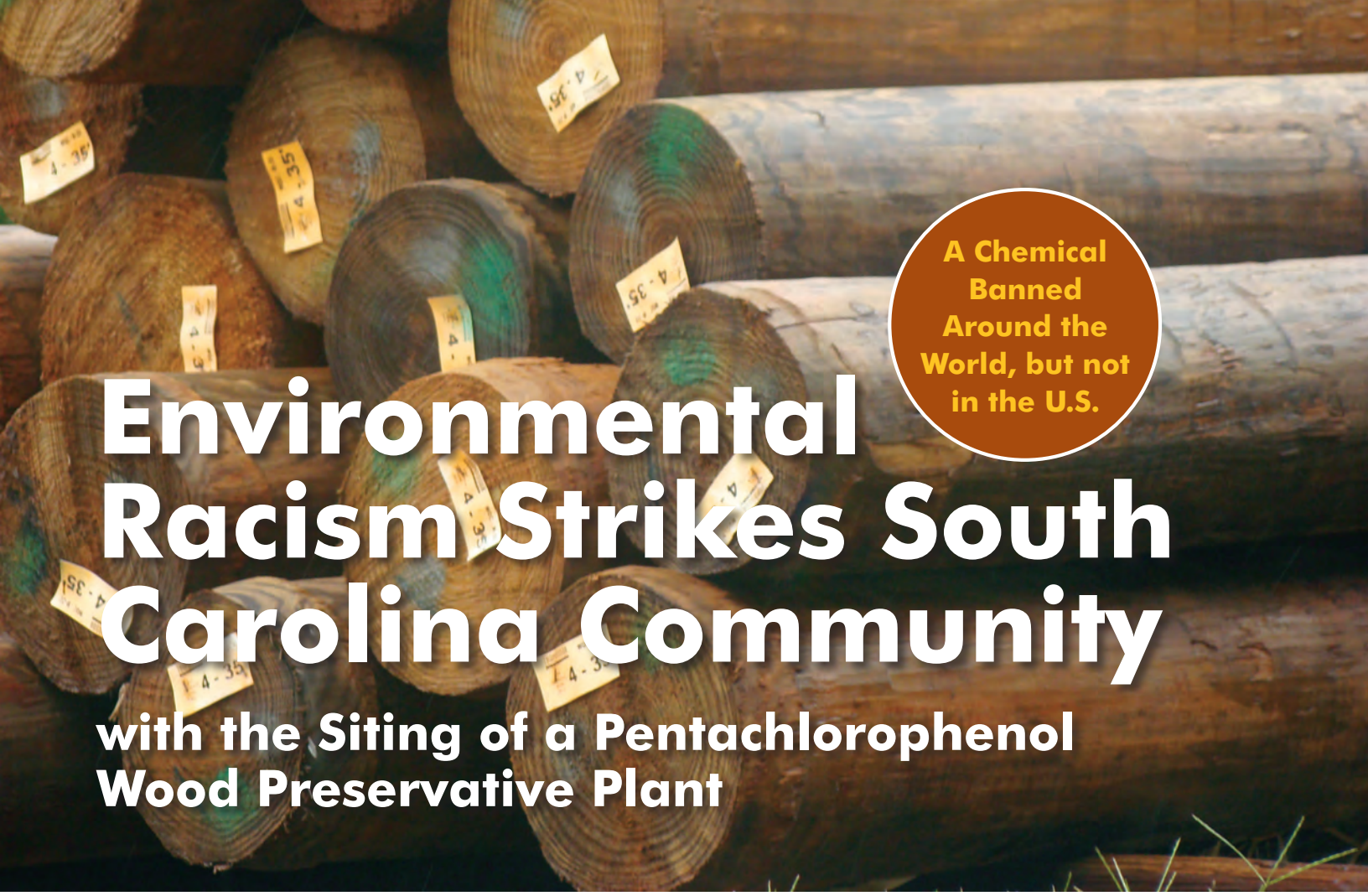

A Chemical Banned Around the World, but not in the U.S.

Environmental Racism Strikes South Carolina Community

with the Siting of a Pentachlorophenol Wood Preservative Plant

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The manufacturer of the most toxic chemical known to humankind slated to move from Mexico to a majority low-income African American community until local residents, a newspaper, and legislators stepped in to stop it.

DREW TOHER

Gulbrandsen Chemicals Inc. sought to make Orangeburg, South Carolina, a majority African American community with three times the United States poverty rate, the last place in the world to produce one of the most toxic pesticides known to humanity, pentachlorophenol (penta)—a wood preservative used to treat utility poles, railroad ties, and wharf pilings. That is, until residents found out about these plans.

The U.S. is one of the few countries on earth that continues to allow the use of this hazardous wood preservative. One hundred and 86 nations, not including the U.S., signed on to a global treaty, the Stockholm Convention (2001), which banned penta in 2016—declaring the chemical a Persistent Organic Pollutant (POP). When Mexico announced that its last production plant would close by 2021, companies scrambled to fill in the market, and Gulbrandsen set its sights on Orangeburg. This set in motion a series of high-profile investigative reports, community advocacy, and political action that ultimately resulted in a major victory for environmental justice, as Gulbrandsen dropped its plans to poison Orangeburg's residents and environment.

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OVERVIEW AND HISTORY

Penta is used to pressure treat wood as a method of prolonging its use in utility poles, railroad ties, and wharf pilings. Beyond Pesticides has been sounding the alarm on penta and other wood preservatives for over 30 years, in its reports *Poison Poles* (1997) and *Pole Pollution* (2000), which outline the science on the hazards and alternatives to preservative-treated utility poles.

Penta is a particularly concerning wood preservative, as it is well known to be contaminated with hexachlorobenzene, polychlorinated dibenzo-p-dioxins, and

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furans. Acute exposure through inhalation or contact with penta-treated products can result in severe irritation. Chronic risks include damage to organ systems like the liver and kidney, as well as impacts on immune, nervous, and endocrine system functioning. EPA reviews previously classified penta as a probable carcinogen, however its Integrated Risk Information System recently classified it as "likely to be carcinogenic." EPA estimates that at least 1 in 1,000 workers are likely to develop cancer during their career at a penta production plant.

Regulation of penta began in the late 1970s, when EPA identified extraordinarily high risks to human health. Penta, along with other wood preservatives, was subject to a Special Review, during which EPA considers product efficacy data (not considered during a standard registration review, which assumes product benefits), but does not adequately consider the availability of nontoxic alternatives. As a result of sustained industry pressure on the agency, EPA soft-pedaled its review to focus on "risk-reduction measures," rather than meaningful regulations. Prior to its review in the 1970's, penta was available to the general public for use as an insecticide, fungicide, herbicide, molluscicide, algicide, disinfectant, and as an ingredient in antifouling paint. In 1984, EPA ultimately removed residential uses by classifying penta as "restricted use," and only available to certified pesticide applicators. But the agency allowed widespread community exposure through treated utility poles and railroad ties to continue.

Curtailment of uses and personal protective equipment requirements have not adequately addressed significant levels of dioxin contamination that occur during the manufacturing process and continue to pose threats to public health as a result of leaching from treated wood into groundwater and the wider environment. Instead of imposing stricter dioxin limits of one part per million, EPA in the late 1980s negotiated with the chemical's manufacturers to permit a phase down to two parts per million over several years. Despite decades of time to improve in production processes, current EPA documents show dioxin and other contaminants, such as hexachlorobenzene, remain at hazardous levels in penta treated wood (19.3ppm and .55ppm average in 2013).

Beyond Pesticides (along with the Communication Workers of America, the Center for Environmental Health, and Joseph and Rosanne Prager) sued EPA in 2002 over its inaction on penta, urging the agency to cancel and suspend the registrations of all toxic wood preservatives on the market.[7] Although the court initially issued a preliminary injunction, the case was ultimately struck down by U.S. District Court Judge Richard Leon based on administrative issues rather than on the merits. Since then, EPA has continued to skirt responsibility to address this highly hazardous chemical with changing risk assessment calculations. In one notable instance, penta review documents from EPA calculated a 2.2 in 10,000 cancer risk to children playing around treated poles. This rate was 200 times above EPA's acceptable cancer threshold. But rather than protect children, EPA simply removed the exposure scenario for children from its analysis and echoed a claim by the Penta Council, an industry group, that "play activities with or around pole structures would not normally occur."

DISPOSAL

Disposal of hazardous wastes is regulated under the *Resource Conservation and Recovery Act*. Under this law, hazardous wastes are defined by what is known as a "toxicity characteristic," which is based on assumptions such as the pH expected in landfill soils. Because penta levels on wood waste fall below EPA's defined hazard threshold,

"Penta review documents from EPA calculated a 2.2 in 10,000 cancer risk to children playing around treated poles. This rate was 200 times above EPA's acceptable cancer threshold."

Penta's Regulatory Status in North America

While the vast majority of 152 countries that are signatories to the 2001 Stockholm Convention accept and implement listing decisions, new rules established under the treaty in 2018 allow individual countries to determine whether to ratify or accept bans on specific chemicals. The treaty, which the U.S. has never ratified, bans Persistent Organic Pollutants. In penta's case, 16 countries have not yet accepted the ban.[9] Despite receiving a 5-year exemption for the last penta production plant in North America, Mexico ultimately signed on to phaseout penta production and use by the end of 2021. To the frustration of many international advocates, Canada has not yet ratified a penta ban. But it may do so soon. A special review of the chemical, published in July 2020 by the country's Pest Management Regulatory Agency, proposes an outright ban that advocates are urging regulators to finalize. Many are hopeful that if Canada and Mexico eliminate penta use, there will be sufficient pressure for the U.S. to follow suit. EPA is in the process of evaluating penta under a review required by federal law to occur every 15 years, but has not yet published a regulatory decision.

As EPA's lax regulation of penta continues, the quantity of wood preservatives used in the U.S. continues to be high. EPA's latest reports of pesticide use do not include wood preservatives as a category, but the agency's numbers lead to the conclusion that wood preservative use on the whole (including penta, creosote, copper chromated arsenate, and others) is equal to at least a quarter of all agricultural pesticide use.

The Case for Alternatives to Pentachlorophenol

Steel, concrete, and composite alternatives to hazardous wood preservatives yield a lifespan of 80 to 100 years. Borates have been an effective alternative wood treatment as well. When considering alternatives, it is important to understand the differences in maintenance costs associated with different materials. Wood preservatives are likely to require re-treatment, which some utilities perform on a set cycle, while steel, concrete and fiberglass do not. In addition, disposal costs for chemicals used in wood treatment are high and continue to grow, while steel can be recycled. Communities may also choose to bury their utility lines if conditions are appropriate.

treated wood waste circumvents federal regulations that would require disposal in landfills. EPA's current guidance tells homeowners who find penta-treated wood on their property, "it can usually be disposed of by ordinary trash collection." For non-households, the agency indicates it is the responsibility of the individual generating the waste to determine whether it is hazardous, indicating that state and local governments may have more specific instructions. This lackadaisical approach to regulating hazardous wastes permits widespread contamination of the environment and reuse of treated wood.

STORAGE

Storage yards for poison poles can also be a significant source of environmental pollution. In 2009, the Ecological Rights Foundation (ERF) sued California utility company Pacific Gas & Electric (PG&E) for contamination of waterways and wildlife caused by the placement and storage of penta-treated poles. The suit focused on the ability for dioxin to leach out of the poles and bioconcentrate throughout the food chain, harming fish, birds, sea lions, and people. After nearly a decade in the courts, a settlement was reached, requiring PG&E to identify all storage yards containing penta poles and implement technologies that reduce the runoff of dioxin. These technologies include storage improvements such as covering or bringing pole storage indoors, improving measures that treat stormwater, and further consideration for PG&E to utilize alternatives like concrete and steel.

STOCKHOLM CONVENTION BAN

While EPA continues to drag its feet, an international treaty, Stockholm Convention on Persistent Organic Pollutants, was brought into force. Signatories to the Stockholm Convention are committed to eliminate the production and use of hazardous chemicals voted on by member countries. The U.S. is glaringly absent from this treaty, signing it in 2001, yet never ratifying it in the Senate. According to the U.S. State Department, "The United States participates as

an observer in the meetings of the parties and in technical working groups." Indeed, despite not signing the treaty, the U.S. was deeply involved in opposing a proposed ban on penta when discussions began at a United Nations committee in 2014.

Despite opposition from the U.S. and India, which is a minor producer of the chemical, the Stockholm Convention voted to impose the strictest ban possible on penta, beginning in 2016. This set a clock ticking on the last North American penta plant, located in Matamoros, Mexico. Mexico was granted a five-year exemption from the treaty in order to provide time to shift production. With 2021 fast approaching, the plant's owner, Cabot Microelectronics, announced it would stop manufacturing the chemical in order to comply with the Stockholm Convention. Around the same time, Gulbrandsen Chemicals Inc., a company that lists its headquarters in South Carolina, but appears to have ties to India, announced it would bring a production plant to Orangeburg.

BRINGING MEDIA ATTENTION AND ACTIVISM TO ORANGEBURG'S FIGHT

The U.S. has long been the largest consumer of penta, and as a result has an extended history with the chemical's manufacturing process. Hundreds of Superfund sites (under the *Comprehensive Environmental Response, Compensation, and Liability Act* [CERCLA]) throughout the country are designated as such because they were contaminated by previous penta production. According to research Beyond Pesticides conducted in *Pole Pollution* in the late 1990s, roughly 250 sites on the Superfund National Priorities list were contaminated with penta.

With this history and context in mind, Beyond Pesticides relayed this information to Sammy Fretwell, a reporter from *The State* newspaper in South Carolina. (Both Beyond Pesticides and Mr. Fretwell were tipped off about Gulbrandsen's plans by a concerned local resident.) Mr. Fretwell published an indepth article laying bare the hazards of penta, subsequently activating a grassroots network of health and environmental justice advocates in the community. Other newspapers picked up the story, a change.org petition was started, and a website, envjustice2020.org, was created to organize against the plant.

This flurry of activism brought about a swift response from some South Carolina's lawmakers. Shortly after *The State*'s piece was published, South Carolina Representatives Russell Ott and Gilda Cobb Hunter introduced a joint resolution to place a moratorium on penta production. "It gives us time to get a better understanding of what this is," said Representative Ott, a lawmaker whose district intersects with Orangeburg, to *The State*. He continued, "Clearly it has been banned in over 150 countries. We want to give everybody an opportunity to have their say, but in the meantime, this places a moratorium on the production."

Local politicians were rightfully concerned that the chemical would disproportionately affect the community's low-income and people of color residents. "I certainly am not interested in Orangeburg County being the home of manufacturing a chemical that has the kind of detrimental effects I've read about,'' said Representative Cobb-Hunter, in whose district the planned production site was to be located. Reports indicate the site was planned to be constructed near a retirement community and an assisted living facility.

When asked for comment, Beyond Pesticides emphasized that a delay was not enough. "It's encouraging to see state lawmakers step in to delay the opening of a new penta plant in South Carolina, but the fact is, it never should have been considered in the first place," the organization said in a statement to the paper. "Pentachlorophenol production in South Carolina would harm workers, poison the surrounding environment, and set Orangeburg up as a future Superfund site. The rest of the world has already moved to alternatives."

The flurry of local activity, from community leaders to regulators to politicians, put immense pressure on Gulbrandsen, which announced, less than two weeks after *The State*'s first investigative report, that it would drop its plans to move forward with penta production. Edisto Riverkeeper Hugo Krispyn, whose group at the headwaters of the North Fork of the Edisto River fought against the plant due to concerns over contamination of recreational waterways, told *The State* that no official he spoke with supported penta production. "Everybody I spoke to, top to bottom, left and right, thought it was a hideous idea," Mr. Krispyn said. In announcing its withdrawal, Gulbrandsen cited delays in state regulatory approvals and community outcry as the primary drivers for the decision.

"After meeting with state regulators regarding the permitting process to produce penta, we have determined we will be unable to meet our business timeline needed to move forward with this project,'' the company said in a statement. "Given that fact, and the helpful feedback we have received from members of our community, we have decided to forgo plans to produce penta."

With Gulbrandsen's threat to Orangeburg officially eliminated, one concerning question remains; whether another company will make an attempt to continue producing this highly hazardous chemical. Without action from EPA to ban the chemical or the U.S. Senate to ratify the Stockholm Convention, the possibility looms large and will necessitate constant vigilance, particularly for low-income communities already subject to toxic insult. As Orangeburg's experience shows, penta has no place in the 21st century and it is abhorrent for the U.S to continue to embrace the use of this hazardous, dioxin-contaminated wood preservative. If the threat emerges in other communities, Orangeburg has provided the roadmap: factual reporting and strong community engagement with elected leaders can deliver environmental justice.

For a version of this article with citations, please go to Pesticides and You *webpage* https://www.beyondpesticides.org/resources/journals.

THE TRUTH ABOUT TRUGREEN

JAY FELDMAN

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It was widely advertised in 1992 when TruGreen merged with ChemLawn, the company whose name embodied a business plan with sole dependency on toxic synthetic chemicals. The company moved its trucks with tanks of toxic pesticides and synthetic fertilizers through communities across the country where children and pets play, applying toxic materials like water, exclaiming their safety, and extolling their benefits. ChemLawn took the toxic chemicals that invaded modern agriculture and brought the same model to the home lawn, playing fields, schoolyards, hospital and corporate landscapes, municipal campuses, and rights-of-way.

ChemLawn was founded in 1968 by sod farmers and garden center owners in Ohio, so the orientation toward chemical-intensive practices was a part of the company culture from the beginning. However, the trophy for changing U.S. culture on the lawn aesthetic must be given to another company—Scotts-Miracle-Gro Company.

One hundred years before ChemLawn's founding, in 1868, Orlando McLean Scott started selling seed to local farmers out of his hardware store in Marysville, Ohio. He grew the business by selling seed to homeowners, then added synthetic fertilizers to the mix in 1928, soon after the Haber-Bosch process enabled the economical manufacturing of synthetic nitrogen. No longer did growers of plants have to depend on nature to deliver nitrogen through organic matter and soil biology that cycles nutrients naturally.

By the time Scotts, in 1947, introduced Weed and Feed (a mixture of the herbicides 2,4-D or mecoprop and synthetic fertilizer—nitrogen, phosphate, and potassium), the company was part of a cultural revolution that turned lawns of grass, wildflowers, and clover into monocultures of green carpets, mixing synthetic fertilizers and pesticides to kill weeds before they could germinate and tamp down fungus. Everything needed was put in the bag—Scotts 4-Step program. Scotts became a leader in the societal transformation to take the chemicals used as weapons of World War II and integrate them into consumer pesticides.

The merger of Scotts and Miracle-Gro in 1995 was a joining of cultures that ignored nature by feeding plants soluble synthetic nutrients that undermine ecosystems. It was a logical next step for Scotts to purchase the Ortho chemical business of branded home and garden pesticides in 1999, and proudly entered into an exclusive marketing agreement to sell consumer Roundup/glyphosate herbicide products. But, before that, Scotts decided to get into the lawn care service business, when in 1998 it began competing with ChemLawn. Then there was the merger with TruGreen, only to be followed by Scotts getting out of the service business in 2019. Covering its bases in 1998, Scotts purchased the organics company Earth Gro, Inc. Maybe organics is their future?

There is growing recognition in the industry that the public is moving away from the toxic chemical-intensive business model of ChemLawn, now TruGreen. A local lawn care operator in Ohio, writes in its publication, "Over the past 20 years, noted industry experts have cited reasons for the decline of the ChemLawn/TruGreen brand. One of those is the rising awareness of consumers about the chemicals they put on their lawns. More and more homeowners are opting for more natural solutions, including organic lawn care."

KNOWING TOXIC CHEMICALS USED IN LAWN CARE

Chemicals used in lawncare may cause cancer, neurological and immunological illnesses, respiratory effects, or other health or environmental harms. As a result, lawn care pesticide applications in neighborhoods across the U.S. cause involuntary exposure to chemicals that exacerbate respiratory, neurological, and immunological illness and risk factors associated with Covid-19. For example, for decades Beyond Pesticides has pointed out that pesticides typically used in commercial

lawn care cause a range of health and environmental effects, including chemicals such as: (i) the weed killer glyphosate (Roundup), which is identified by the National Toxicology Program and the International Agency for Research on cancer (IARC) of the World Health Organization as probably carcinogenic, (ii) chlorophenoxyacetic acid (MCPA), mecoprop (MCPP), and dicamba (Tri-Power) weedkillers often used in combination or individually, whose label warns of "irreversible eye damage" and "allergic reactions," (iii) trichlorfon (Dylox), an insecticide that is a neurotoxic organophosphate, and (iv) azoxystrobin (Heritage), a fungicide which, along with its degradate, are known to leach into groundwater under certain soil and water depth conditions. *(See Beyond Pesticides' 30 Most Commonly Used Pesticides at* bp-dc.org/30lawncarepesticides.*)*

ADVANCING ALTERNATIVES

Central to Beyond Pesticides' continuing work is shifting the lawn care industry to organic practices and organic compatible products (see *bp-dc.org/organiccompatible*) —a systems approach that eliminates toxic chemical pesticides and fertilizers, builds soil biology, and operates in sync with nature. This approach is successfully and economically used in managing lawns, parks, and playing fields across the country.

For more information on converting your community to organic land management, please see Beyond Pesticides Lawns and Landscape page at bp-dc.org/lawns. *For community-based assistance in converting parks, playing fields, and school property to organic practices, please write Beyond Pesticides at* info@beyondpesticides.org *or call 202-543-5450.*

Beyond Pesticides v. TruGreen: The Settlement

In August, 2020, Beyond Pesticides and TruGreen Limited Partnership ("TruGreen") released the following statement: "Beyond Pesticides and TruGreen Limited Partnership ("TruGreen") today issued the following statement regarding a lawsuit (*bp-dc.org/TruGreencomplaint*) that Beyond Pesticides filed against TruGreen pursuant to the District of Columbia Consumer Protection Procedures Act in the Superior Court of the District of Columbia: The matter has been resolved to the satisfaction of the parties. TruGreen has resolved to modify or remove certain of the marketing statements at issue in the lawsuit.

Beyond Pesticides was represented by Richman Law and Policy, based in Irvington, New York.

TRACKING BIODIVERSITY

SLIME MOLDS

Yellow slime mold

Creative Commons/Frankenstoen

TERRY SHISTAR, PhD

They move, but they are not animals. They can solve problems, but they have no brain or neurons. They have no mouths, but they communicate with each other. They are not plants or animals or fungi. They are the fascinating, sometimes disgusting, creatures known as slime molds, which comprise several types of eukaryotic (having cells with a nucleus enclosed in a membrane) organisms within the kingdom Protista.

Although many slime molds are microscopic (like many Protists), it is the larger slime molds known as Myxogastrids (Myxomycetes) that are most fascinating. A Myxogastrid is a plasmodium—a large amoeba that can be as much as a meter across and weigh as much as 20 kilograms. Slime molds go through several life stages, but are most recognizable in the plasmodium or "slime" stage.

The plasmodium is a single cell, with multiple nuclei, that feeds by engulfing food and ingesting it through phagocytosis, then digesting it. Fungi, in contrast, release digestive enzymes to the external environment. Slime mold plasmodia often attract attention because of their colors—bright yellow, orange, or pink. The plasmodium can move at a rate of 1mm/hour. It creates spindly, vascular-like growths that connect it to food sources.

NO BRAIN, BUT PROBLEM SOLVERS

Slime molds exhibit intelligence even though they do not have a brain. When divided, they move back together.[1] They solve mazes, learning the shortest route to the food reward,[2] share information, and can keep track of time. Brian Resnick, senior science reporter for VOX, explains: "If you spread out oats (slime molds' favorite food) on a map, the slime molds will find ways to connect the sources of food with the shortest possible routes. If you add some obstacles to the map, like salt (which the slime mold hate), they'll find creative ways to avoid

them. When scientists model metropolitan areas in this manner, with the food representing centers of dense populations, slime mold can somewhat accurately recreate maps—like [a] map of the Tokyo rail system. It took human engineers years to map out the system. It took slime mold just a few hours." Because of their problem-solving skills and the ability to teach one another, slime molds of the species *Physarum polycephalum* were given the position of "non-human resident scholar" at Hampshire College in 2017 and have been solving problems with the help of human research assistants, modeling a number of difficult to solve social and environmental problems.[3]

The preferred home of slime molds, however, is not in university laboratories, but in soils of moist places, especially forests, though some species can be found in almost any ecosystem. They eat bacteria and decaying plants, contributing to the recycling of organic matter. Although the majority of Macrogastrid species inhabit open forests, they can be found in snow, deserts, and aquatic environments. They are food for many insects and other arthropods, nematodes, fungi, and bacteria. Some slime molds of the genera *Mucilaga* and *Physarum* are found on turfgrass, but they do not damage living grass and do not require control.[4]

LIFE CYCLE AND SURVIVAL TACTICS

The life cycle of a slime mold begins with germination of haploid (1n chromosomes) spores in favorable moisture and temperature conditions, with formation either a myxamoeba or a myxoflagellate.[5] The former can move on surfaces like an amoeba, and the latter can swim in water. The Myxogastrid can switch between forms depending on conditions. At this stage, they consume bacteria and fungal spores, and probably dissolved substances, and reproduce through cell division.

When a myxamoeba encounters another of appropriate mating type (there can be hundreds of "sexes"), the nuclei and cell contents fuse to form a diploid (2n) myxamoeba. Within the single cell, the nucleus undergoes multiple divisions, resulting in a multinucleate single-celled amoeba, or plasmodium. This is the "slime" form, which can grow to a large size and consumes, through phagocytosis, bacteria, fungi, other single-celled organisms, small organic particles, and dissolved nutrients. The plasmodium may produce a resting stage or sclerotium—a hardened, resistant form consisting of many macrocysts with a round shape and cell wall—allowing it to survive unfavorable conditions. When conditions are right—and it is unknown exactly what "right" is—the plasmodium moves to a light, dry area to produce fruiting bodies or sporocarps and release spores. Sporocarps are quite distinctive—ranging from colorful stalked balls to tufts of chocolate-colored feathery wands to the disgusting pile of spores of the *Fuligo septica*, better known as dog vomit slime mold.

NOTES

1 *https://www.princeton.edu/news/2010/01/21/sultan-slime-biologist-continues-be-fascinated-organisms-after-nearly-70-years*

2 *http://www.abc.net.au/science/articles/2000/09/28/189608.htm?site=galileo&topic=latest*

3 *https://www.vox.com/science-and-health/2018/3/6/17072380/slime-mold-intelligence-hampshire-college*

4 *https://ohioline.osu.edu/factsheet/HYG-3074*

5 Life cycle information from *https://en.wikipedia.org/wiki/Myxogastria*.

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Terry Shistar

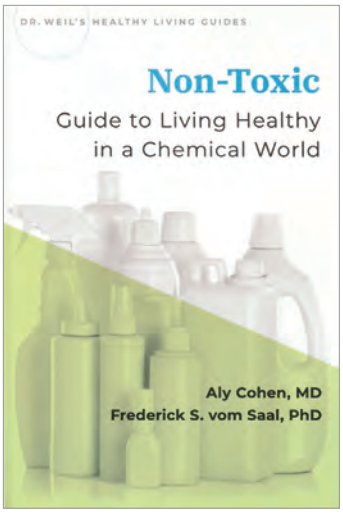
iStockphoto/Nicole Gilbo

Alamy Stock/Sanamyan

1: Yellow slime mold growing on mulch and the leaves of an orchid. 2: Orange slime mold on wild grape vine. 3: Pretzel Slim mold. 4: Sausage shaped white translucent fruiting bodies of slime mold or *myxomycete Stemonitis splendens* growing on wood.

Reviewed by Terry Shistar, PhD

A Guide to Nontoxic Living



Non-Toxic Guide to Living Healthy in a Chemical World (Dr Weil's Healthy Living Guides) by Aly Cohen, MD, FACR, and Frederick vom Saal, PhD. Oxford University Press. 416pp.

Non-Toxic Guide to Living Healthy in a Chemical World is a collaboration between a physician and a pioneer researcher in the field of endocrine disrupting chemicals (EDCs). Research in the field of EDCs challenges approaches to risk assessment used by federal agencies, showing that chemical exposures disrupt development at doses thousands of times lower than had been previously estimated by the Food and Drug Administration (FDA) and the U.S. Environmental Protection Agency (EPA) to cause no effect. Frederick vom Saal, PhD is one of the courageous researchers in the field who has testified about the hazards posed by environmental endocrine disrupting chemicals in numerous state and national legislative and regulatory bodies. Aly Cohen, M.D. is a board certified rheumatologist, integrative medicine specialist, and environmental health expert in Princeton, New Jersey. She is coeditor (with Dr. vom Saal) of the textbook, *Integrative Environmental Medicine*.

I have recently read several books that help explain environmental hazards—and EDCs, in particular—to the non-scientist. Non-Toxic rises to the top for a number of reasons.

First, it is comprehensive in its coverages of hazards, beginning with chapters that establish the context in terms of evolution and history, how chemicals disrupt the endocrine and immune systems, and the special susceptibility of the developing fetus and child. It covers chemicals in food, water, and air, and has chapters focusing on medications, personal care products, cleaning chemicals, pesticides, home furnishings, and radiation. The explanations of toxicity and exposure are clear and accessible to all readers. As one might expect, there is a clear and thorough explanation of EDCs and the problems they pose for risk assessment used by regulators.

For example, the authors explain: "The fact that natural hormones, hormonal drugs, and EDCs all commonly show nonmonotonic dose response relationships demonstrates that the core assumption of toxicology, that only very high doses of chemicals need to be studied to understand their risks to the public at much lower exposures, is false. Yet, as of 2020, the FDA, EPA, and other federal agencies still refuse to abandon the 16th century dogma that testing only high doses of a chemical is sufficient to predict what EDCs will do at the low doses commonly encountered by people." Timing of exposure—or critical windows of vulnerability during developmental phases of life—is as important as dose: "As mentioned throughout this book, the timing of exposure can be just as critical as the type of exposure, whether the exposure is a neurotoxin, an endocrine disruptor, or both. Critical periods include pregnancy, newborn and toddler years, adolescents through late teens, and even menopause; these are all periods characterized by surges in hormone levels resulting in physiologic changes."

I especially like the fact that the authors give real advice for avoiding hazards. In some cases, the alternatives are not difficult. I read "Laptops should not sit on laps!" as I was reading the electronic version from my laptop on my lap. My laptop is now on my desk. Others are not so easy, or outside of our direct control. While pointing out practical ways to reduce air pollution within the home, the authors also point out, "At work, school, or other buildings outside of the home in which you spend time, it is important to promote, speak up, and demand changes if there are sources of contamination not being addressed (such as the use of cleaning chemicals or pesticides). This is also true for the outside air you breathe. . . . Actions to reduce pollutant exposure that are mandated by [environmental laws] are being systematically rolled back to the 'good-old days' of high pollutant levels, which threaten the health of everyone in the name of increased profits for shareholders in polluting businesses."

Since it is especially valuable for parents and parents-to-be, I plan to be giving copies of this book to my young friends and family members.

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