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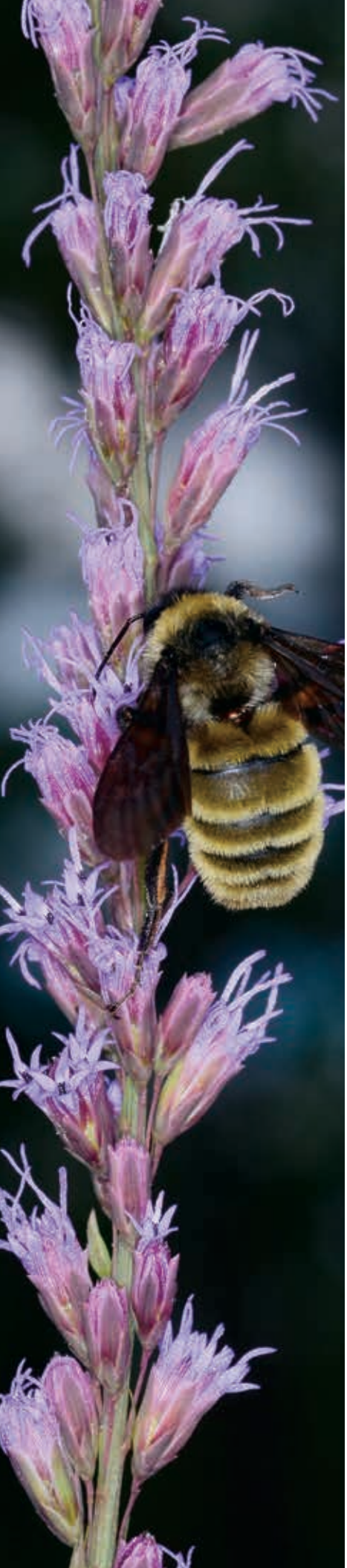
Pesticides *and* You

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

TRANSFORMATIVE CHANGE: Informed by Science, Policy, and Action



Transformative Change
Informed by Science, Policy, and Action

This special issue of *Pesticides and You*, **Transformative Change: Informed by Science, Policy, and Action**, a companion issue to **Retrospective 2021: A Call to Urgent Action**, captures the increasing urgency of the petrochemical pesticide and fertilizer threat to health, biodiversity, and climate, and actions being taken to chart a path for a livable future. Whether talking about serious health threats from chemical-induced diseases, the collapse of life-sustaining biodiversity, or the dramatic destruction caused by greenhouse gases and rising and erratic temperatures, the interconnectedness of the crises requires strategic solutions that are holistic and nurturing of nature.

The failure to heed the preponderance of the independent, peer-reviewed scientific evidence of catastrophic harm on the horizon and the deficiencies in safety standards and risk assessments are a deadly mix. In the U.S. and worldwide, the foundation of conventional agriculture and the management of the built environment are intricately tied to polluting practices, with disproportionate harm affecting segments of the society that are exploited, low income, in ill-health, and disproportionately people of color.

This issue is a tool for transformative change that embraces the viability of clear alternatives. The documented science and the policy failures support Beyond Pesticides' call for an end to petrochemical pesticide and fertilizer use within a decade and compel the widespread and expeditious adoption of organic management to replace chemical-intensive practices.

The findings and citations in this issue are supplemented by Beyond Pesticides' Pesticide-Induced Diseases Database and other documentation housed on the organizations' website. All links to referenced material, highlighted in blue text, are available in the electronic version of this issue, also on the Beyond Pesticides' website.

Contributing writers to this issue include Beyond Pesticides staff (Drew Toher, Akayla Bracey, Jay Feldman, and Jocelyn Cordell), board member and science consultant Terry Shistar, PhD, and writer Debra Simes. Design services by David Gerratt, NonprofitDesign.com.

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NATIONAL HEADQUARTERS

701 E Street, SE Washington DC 20003
ph: 202-543-5450 fx: 202-543-4791
email: *info@beyondpesticides.org*
website: *www.beyondpesticides.org*

TRANSFORMATIVE CHANGE: INFORMED BY SCIENCE AND POLICY

By Jay Feldman

The hazards of petrochemical pesticides and fertilizers to health and the environment are extraordinary and scientifically documented, creating a clarion call for urgent change. We know now what the necessary changes look like, as we seek to respect the gifts of nature—on which all life depends. The purpose of this issue of *Pesticides and You* (PAY) is to capture in the period of one year, 2022, the justification for the urgency that we must bring to our practices and policies. We look at what the science is telling us now, dramatic findings on public health diseases—from cancer, neurological and immunological illness, respiratory disease, learning disabilities, Diabetes, Parkinson's and Alzheimer's—associated with toxic chemical uses that are not needed, but widely applied, to produce our food and manage our landscapes.

Science Calls for Transformative Change

This issue contains a cross section of current science that documents the depth and breath of the problem and the destructive path we are on. This issue adds to a similar accounting in this journal last year, *Retrospective 2021: A Call to Urgent Action*. Together, these issues serve as a compendium of the shocking scientific findings that compel us to act in our communities, states, and as a nation and world community. We publish this issue as a tool for education and the basis for action—to shift to organic practices clearly defined by the elimination of the toxic chemicals we track. As readers will see, this is not about banning or restricting a couple, or even several dozen, petrochemical pesticides and fertilizers, but is about a transformation to land and building management systems that align with nature and, at the same time, are more

The transformative solution is a partnership with nature, practices that have been adopted in organic systems. With this approach, we honor all organisms who play a role in ecological systems on which life depends and we seek the rapid adoption of those practices and materials that are already available to us or can be incentivized to become widely available quickly.

effective and efficient at producing food and contributing to our quality of life.

Partnership with Nature

The transformative solution is a partnership with nature, practices that have been adopted in organic systems. With this approach, we honor all organisms who play a role in ecological systems on which life depends and we seek the rapid adoption of those practices and materials that are already available to us or can be incentivized to become widely available quickly. In the organic sector, we have spent the last several decades embracing values and principles that respect nature and seek continuous improvement in real time, not bogged down in long bureaucratic delays, but motivated by the sense of urgency that is required. Now, these changes must become mainstream and show a path forward for all sectors that have become dependent on chemicals, which are destructive of health and the environment. This is not a simple product substitution approach to change, or a new way of storing toxic waste, or better braking systems on trains carrying toxic substances (although short-term fixes are needed), but a preventive and precautionary strategy that embraces nature first.

Science, Policy, and Action

The science that has accumulated in 2022 adds to an alarming and even higher degree of urgency than captured in the 2021 issue. With this edition, we organize the body of information into three categories—science, policy, and action. This body of science is organized into three major sections to address the clearly defined and escalating threats: a public health crisis, biodiversity collapse, and the climate emergency. The discussion and science call for transformative change that is no longer held back by those with a vested economic or political interest in continued pollution, small fixes to the status quo, or a reduction in problems that continue to be unsustainable. The time horizon for the health, biodiversity, and climate crises that now plague us does not give us the luxury to tweak broken policies or tinker with half-measures.

Beyond Pesticides is focused on public health and environmental protection—and advancing alternatives that prevent harm. This issue asks readers unfamiliar with the need for urgent action to think holistically when considering status quo dependency on petrochemical pesticide and fertilizer use in their community and on their property. We look at the use of toxic chemicals and evaluate them through their life cycle—from manufacture, transportation, storage, use, and disposal—and consider pesticides in the context of alternative practices and materials that can eliminate their use. In this context, our personal and community decisions have adverse impact, as articles in this issue show, on low-income people, people of color, fenceline communities near production facilities, communities experiencing chemical drift and poisons in the air, and those with preexisting health conditions—showing that adverse effects are not limited to individual users of toxic products or consumers of pesticide-treated food. Our community and personal decisions determine the future well beyond the boundaries of our home and community.

Chemical Pollution Exceeds Safe Limits for Humanity

At this point, it is clear that we have answers to the problem of petrochemical pesticide and fertilizer dependency and this issue of *PAY* reinforces, with greater urgency than even one year ago, that we delay with incrementalism at our peril. So, we begin this issue with yet another wake-up call published in *Environmental Science and Technology*, "Outside the Safe Operating Space of the Planetary Boundary for Novel Entities," in which scientists are telling us that global chemical pollution has now exceeded a safe limit for humanity—exceeding the planetary boundary. The authors conclude that we are passing "the point at which human-made changes to the Earth push it outside the stable environment of the last 10,000 years."

From pesticides, to plastics, to energy, the complexity of factors is broad, but in the arena of land management, both in the production of food and the caretaking of parks, playing fields, and public spaces, we can and must lead the way in embracing organic as the elimination of petrochemical pesticides and fertilizers.

From pesticides, to plastics, to energy, the complexity of factors is broad, but in the arena of land management, both in the production of food and the caretaking of parks, playing fields, and public spaces, we can and must lead the way in embracing organic as the elimination of petrochemical pesticides and fertilizers. Rodale Institute's Farming Systems Trial: 40-Year Report, published in 2022 and the subject of the final article in this edition, explains with empirical research that we now have the tools and experience to shift to organic agriculture as a nation and globe, with extraordinary benefits for health, biodiversity, and climate, and increased profits for farmers.

We cannot any longer justify the use of petrochemical pesticides and fertilizers, nor can we accept strategies that "reduce" use and adopt risk mitigation measures. Instead, we must embrace a dramatic change in land management that eliminates toxic chemicals. We must demand more of our policies, policymakers, and those with the discretionary power to implement the necessary changes.

This issue of *PAY* is intended to add to the body of information that informs advocacy for transformative change—in communities, school districts, park districts, public lands, private property, and state and federal government. The science tells us that we can no longer—and we do not need to—compromise with our lives and the lives of the next generation.

SCIENCE DEFINES THE THREAT | JANUARY 21, 2022

Global Chemical Pollution Exceeds Safe Limits for Humanity

The bottom-line conclusion of a recent study is that global chemical pollution has now exceeded a safe limit for humanity. As reported by *The Guardian*, "The cocktail of chemical pollution that pervades the planet now threatens the stability of global ecosystems upon which humanity depends." Published in *Environmental Science & Technology*, the research paper asserts that the creation and deployment (into the materials stream and environment) of so many "novel entities" (synthetic chemicals) is happening at a pace that eclipses human ability to assess and monitor them. The study team calls this exceedance of the "planetary boundary" of such chemical pollution "the point at which human-made changes to the Earth push it outside the stable environment of the last 10,000 years." According to Beyond Pesticides, which covers pesticide (and other kinds of) chemical pollution, these results underscore a grim twin reality to the human-caused climate emergency, and should be a dire warning on the state of our shared environment and a time for systemic movement to eliminate fossil fuel-based pesticides and fertilizers.

Hailing from Sweden, the United Kingdom, Canada, Denmark, and Switzerland, members of the research team define "novel entities" as those compounds and materials introduced by humans that "are novel in a geological sense and that could have large-scale impacts that threaten the integrity of Earth system processes." The novel entities that have so suffused Earth's air, water, ecosystems and biodiversity, wildlife, and human bodies comprise 350,000 synthetic chemicals—including persistent organic pollutants (POPs) and volatile organic compounds (VOCs)—found in plastics, synthetic pesticides and fertilizers, industrial and manufacturing compounds, antibiotics, degreasers, cleaning agents, and many other commodities. Only a tiny fraction of those 350,000 compounds has been assessed for safety, yet many are now found in human tissues. (See the Beyond Pesticides web page on "body burden" of synthetic chemicals and the relationship to disease development.)

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Although there is no consensual metric attached to the category of "novel entities," the researchers assert that the human introduction of them is

globally concerning because "these entities exhibit persistence, mobility across scales with consequent widespread distribution and accumulation in organisms and the environment, and potential negative impacts on vital Earth System processes or subsystems."

The introduction of synthetic chemicals into the materials stream began in 1869 with the creation of chloral hydrate (a sedative) and the first nearly synthetic polymer, celluloid, which was developed as a substitute for ivory. Such innovations, which began in the 19th century as a trickle of new compounds and materials, yielded in the first half of the 20th century materials such as nylon, Bakelite (the first fully synthetic plastic), and the first synthetic fluorocarbon. But it was the advent of World War II and the decades to follow that opened a firehose of new materials, as military—industrial research spawned a universe of new chemicals and materials.

Many of those were plastics; during the war, U.S. plastic production increased by 300%. The plastic surge continued throughout the rest of the 20th century, and is unabated today. Indeed, 2020 estimates clocked the amount of plastic in the world at roughly 8.3 billion tons—with 6.3 billion of those tons being "trashed" plastic. As UNEP (United Nations Environment Programme) invites us to consider: "Imagine 55 million jumbo jets and that's how much plastic exists."

Beyond plastics, the 20th century spawned a new world of chemical compounds that were engineered into nuclear and chemical weapons, pes-ticides, and the universe of nearly 5,000 PFAS (per- and polyfluoroalkyl) substances, among others. Patricia Villarrubia-Gómez, a PhD candidate and member of the research team, commented, "There has been a fiftyfold increase in the production of chemicals since 1950 and this is projected to triple again by 2050. The pace [at which] societies are producing and releasing new chemicals into the environment is not consistent with staying within a safe operating space for humanity."

Were all these synthetic compounds chemically inert, the implications for human and environmental health might be quite different. However, biological organisms *do* interact with many of them, causing largely unknown, unpredictable (except as they are studied retrospectively), and frequently, harmful impacts to all manner of organisms, from archaea to armadillos to humans (never mind the ecosystem impacts).

The extensive chemical pollution this study documents is a threat to the functioning of Earth's systems because, the biological and physical processes that underpin all life. For example, pesticides wipe out many nontarget insects, which are fundamental to all ecosystems and, therefore, to the provision of clean air, water and food." Rebecca Altman, PhD, member of the Board of Directors of Science and Environmental Health Network, has written in the article, "Time-bombing the future," this pithy sentence: "Synthetics created in the 20th century have become an evolutionary force, altering human biology and the web of life."

The study paper notes that toxic plastic pollution—which is now found, as *The Guardian* puts it, "from the summit of Mount Everest to the deepest oceans"—is of especial concern. One of the researchers, Professor Bethanie Carney Almroth, commented, "There's evidence that things are pointing in the wrong direction every step of the way. For example, the total mass of plastics now exceeds the total mass of all living mammals. That to me is a pretty clear indication that we've crossed a boundary. We're in trouble, but there are things we can do to reverse some of this." The research paper asserts that the high social (health, environmental, economic, et al.) costs of the impacts of these "novel entities" are a potent argument for strong and urgent action.

The rise of the chemical burden in the environment is diffuse and insidious. Even if the toxic effects of individual chemicals can be hard to detect, this does not mean that the aggregate effect is likely to be insignificant. Regulation is not designed to detect or understand these effects.

According to *The Guardian*, Professor Sir Ian Boyd of the University of St. Andrews notes: "The rise of the chemical burden in the environment is diffuse and insidious. Even if the toxic effects of individual chemicals can be hard to detect, this does not mean that the aggregate effect is likely to be insignificant. Regulation is not designed to detect or understand these effects. We are relatively blind to what is going on as a result. In this situation, where we have a low level of scientific certainty about effects, there is a need for a much more precautionary approach to new chemicals and to the amount being emitted to the environment."

The researchers say that stronger regulation and a fixed cap on chemical production and release are needed—initiatives analogous to the maximum carbon targets that have been established (if not necessarily honored) in some locations to reduce greenhouse

gas emissions. Increasingly, members of the global science and health communities are calling for action on reining in the flow of synthetic chemicals and plastics, into the environment—including the establishment of a global scientific body for chemical pollution akin to the Intergovernmental Panel on Climate Change (IPCC).

A 2009 study, "Planetary Boundaries: Exploring the Safe Operating Space for Humanity," asserts that there are nine "planetary boundaries" within which humans should operate in order to avoid disastrous consequence. These boundaries relate to climate change, biodiversity loss, the nitrogen cycle, the phosphorous cycle, stratospheric ozone depletion, ocean acidification, global freshwater use, changes/intensification of land use, atmospheric aerosol loading, and chemical pollution. The study authors note that in 2009, *three of those nine interlinked planetary boundaries* had already been transgressed.

In late March 2021, *Mongabay* published an article, "The nine boundaries humanity must respect to keep the planet habitable," which set out a very slightly revised system of boundaries and a sober warning. "All life on Earth, and human civilization, are sustained by vital biogeochemical systems, which are in delicate balance. However, our species—due largely to rapid population growth and explosive consumption—is destabilizing these Earth processes, endangering the stability of the 'safe operating space for humanity.' Scientists note nine planetary boundaries beyond which we can't push Earth Systems without putting our societies at risk.... Humanity is already existing outside the safe operating space for *at least four of the nine boundaries* [emphasis by Beyond Pesticides]: climate change, biodiversity, land-system change, and biogeochemical flows (nitrogen and phosphorus imbalance)."

The subject study confirms that humankind has now pushed past the *fifth of the nine boundaries* in its planet-wide synthetical chemical pollution that is damaging the biological and physical processes that underpin all life. Beyond

When we advance reform, we do not want to just tinker with a failed risk assessment-based regulatory system.... We want to eliminate the use of these toxic materials, starting from the ground up.

Pesticides has long taken to task the regulatory bodies in the U.S., particularly the Environmental Protection Agency (EPA) for its multitude of failures in regulating pesticides. But EPA also regulates non-pesticide synthetic chemicals and materials, as do other federal agencies, including the Occupational Safety and Health Administration (OSHA), Department of Transportation (DOT), and Nuclear Regulatory Commission (NRC).

Comporting with Professor Boyd's points, Beyond Pesticides has repeatedly asserted that a "whack-a-mole" approach to regulation of pesticides, and toxic synthetic chemicals broadly, is decidedly not a precautionary way forward. What is needed urgently is a holistic, precautionary approach to the deployment of *all* synthetic chemicals, domestically and around the world, given the apparent lack of urgency among policymakers to take action, and the piecemeal chemical regulations that abound in the U.S. and abroad. As noted previously, the researchers are recommending an international body to address these issues.

Beyond Pesticides wrote in its *Pesticides and You* journal two winters ago (see p. ii): "When we advance reform, we do not want to just tinker with a failed risk assessment-based regulatory system.... We want to eliminate the use of these toxic materials, starting from the ground up. This means that we, as a part of our decision-making process—whether in a community or [in] federal law—must look at whole ecological and biological systems, the range of interactions that are possible, and reject any harm. With alternatives available, there is no reason to accept anything less."

SOURCES: Linn Persson, Bethanie M. Carney Almroth, Christopher D. Collins, Sarah Cornell, Cynthia A. de Wit, Miriam L. Diamond, Peter Fantke, Martin Hassellöv, Matthew MacLeod, Morten W. Ryberg, Peter Søgaard Jørgensen, Patricia Villarrubia-Gómez, Zhanyun Wang, and Michael Zwicky Hauschild *Environmental Science & Technology* 2022 *56* (3), 1510-1521, https://pubs.acs.org/doi/10.1021/acs.est.1c04158; The Guardian

SCIENCE

Human Health Threats | Biodiversity | Climate

The dire health, biodiversity, and climate crises and their link to petrochemical pesticide and fertilizer use (and related production, transportation, storage, and disposal) support nothing less than systemic change to the practices and policies that have brought on a confluence of never-before-seen threats to life. This section on science tracks the independent, peer-reviewed scientific literature that links pesticides to a dizzying array of health and environmental effects. This science empowers calls for change that, going beyond typical pesticide mitigation and reduction measures or specific chemical phaseouts, adopt strategies to eliminate toxic pesticide dependency and embrace organic practices and policies. The science reflects a pattern of pesticide-induced illness and disease throughout ecosystems that is generational and escalating exponentially, as captured in this section and on the Beyond Pesticides website.

CHILDREN'S HEALTH | MOTOR SKILL DEFICIENCY | JANUARY 5, 2022

Household Pesticide Use Harms Infant Motor Skill Development

Household pesticide use is associated with harmful impacts to infant motor development, according to a study published late last year in the journal *Pediatric and Perinatal Epidemiology*. The research focuses on primarily low-income Hispanic women located in Los Angeles, California, enrolled in an ongoing study referred to as Maternal and Developmental Risks from Environmental and Social Stressors (MADRES). Low-income, people of color communities are disproportionately in contact with toxic pesticides and other pollutants, resulting in exposures that can start early and affect health over the course of one's lifetime.

Overall, roughly 22% of mothers reported pesticide use in their home during the first months of their children's lives. The analysis reveals that 21 of the infants tested fall below the cut-off for the screening tool that suggests further evaluation by a health professional. "In adjusted models, infants whose mothers reported household use of rodent or insect pesticides had 1.30 (95% CI 1.05, 1.61) times higher expected gross motor scores than infants in households with no reported household pesticide use, with higher scores indicating decreasing gross motor performance," the study indicates.

Women enrolled in the MADRES cohort are over the age of 18 and speak English or Spanish fluently. For the present study, roughly 300 MADRES participants met the criteria for enrollment and completed household pesticide use questionnaires at a three-month postnatal visit. The questionnaire generally inquires whether pesticides had been used in one's home since their child was born. After another three months, researchers also tested infants' motor development using an Ages and Stages-3 protocol screening tool, which evaluates a child's ability to execute muscle movements.

Household pesticide use over the last decade has generally shifted away from the use of older organophosphate chemistries to the use of synthetic pyrethroid insecticides. But this switch has not resulted in safer exposures; a growing body of literature is finding that synthetic pyrethroids can cause a range of adverse health impacts, particularly in children. Multiple studies have been published linking synthetic pyrethroids to developmental problems in children. Most recently, a 2019 Danish study finds that higher concentrations of pyrethroid insecticides corresponds to higher rates of attention-deficit/hyperactivity disorder (ADHD) in children. Pesticide exposure at a young age can have far-reaching effects. In addition to motor skills and learning development, young boys exposed to synthetic pyrethroids are more likely to experience early onset of puberty.

These data are all the more concerning in the context of findings that show how synthetic pyrethroids can persist as residue on hard surfaces in one's home for over a year. This persistent residue can result in multiple re-exposures, turning what an individual may consider a one-time use into a chronic exposure event. Unfortunately, for

many low-income residents in the U.S., pesticide use in and around one's home or apartment is not a decision they can make. Many property management companies, landlords, and public housing authorities have ongoing service contracts with chemical pest control companies. This outdated and dangerous approach to pest management, which often includes service visits that prophylactically spray toxic pesticides without considering need, results in disproportionate exposure to low-income individuals who may otherwise be keeping a spotless home. It is little wonder why studies can match disease risk to zip code, with individuals in low-income, indigenous and people of color communities at greatest risk of developing pesticide and other environmentally-induced diseases.

What to do: While research finds that feeding kids an organic diet improves scores on tests measuring memory and intelligence, the additional use of pesticides in one's home can undermine those benefits. Ultimately, everyone should have access to healthy food grown without pesticides and be able to live a life without mandated exposure to toxic pesticides that undermine your and your family's health. For assistance on stopping household pesticide use and managing household pests without chemicals, see Beyond Pesticides' ManageSafe webpage, or reach out at info@beyondpesticides.org.

SOURCE: Hernandez-Castro, I, Eckel, SP, Chavez, T, et al. Household pesticide exposures and infant gross motor development in the MADRES cohort. *Paediatr Perinat xEpidemiol*. 2022; 36: 220– 229.doi: 10.1111/ppe.12850.

CHILDREN'S HEALTH | PRENATAL EXPOSURE AND EAR INFECTIONS | FEBRUARY 9, 2022

Pesticide Use During Pregnancy Increases Childhood Risk of Ear Infections

Insecticide use during pregnancy significantly increases the occurrence of Otitis Media (OM), an infection of the space behind the ear drum, in infants, according to research published in *Scientific Reports* from a team of Japanese researchers in January. While most infections go away on their own, some children experience pain, fever, and in some cases complications that result in hearing loss. This research underscores the myriad of dangers and diseases that pesticide use can precipitate, which are not considered under risk assessments conducted by the U.S. Environmental Protection Agency (EPA).

Scientists collected their initial data from the ongoing Japan Environment and Children's Study, a national birth cohort study that evaluates environmental factors affecting children's health in Japan. Data recorded include factors such as maternal age, birth weight, and gestation weeks, and mothers provided answers to a range of questionnaires, including one relating to exposure to insecticides during pregnancy. Study authors utilize a range of other covariates to control for further risk factors, such as family history of OM, living

with other siblings, nursery attendance, parental smoking habits, and others.

The study determined that OM during an infant's first year of life is most closely associated with insecticide use more than one time per week between conception and the first trimester of pregnancy. Insecticide use in the second and third trimester is not associated with OM. Researchers speculate that insecticide use causes OM due to weakened immune function in exposed individuals.

This is the first study to show a connection between ear infections in young children and pesticide exposure during pregnancy. Prior research, however, has provided some indication that pesticides can harm the ears and affect hearing. A 2020 study published in the Annals of Work Exposures and Health found that farmworkers exposed to a combination of pesticides and noise from agricultural machinery were at increased risk of hearing loss.

Roughly 1 in 5 children experience several episodes of OM in short spans during early life. The cost of these treatments can add up significantly, accounting for several billion dollars in health care costs. Additionally, "Preventing OM decreases the burden that is placed on parents who have to visit clinics and take time off work," the authors indicate.

This is the first study to show a connection between ear infections in young children and pesticide exposure during pregnancy. Prior research has provided some indication that pesticides can harm hearing.

Results highlight the hidden risks that individuals tacitly accept when applying a substance intended to kill life. Chemicals like the increasingly common synthetic pyrethroid class of insecticides can remain on hard surfaces for over a year, providing continual, chronic exposure. These exposures can weaken immune system functioning and make individuals more susceptible to infection and other diseases.

Pregnant mothers, fetuses, and young children are at greatest risk from household pesticide use, as evidenced by a large and growing body of research. Exposure during and after pregnancy has been associated with increased risk of cancers, including infant leukemia and childhood brain tumors. Pregnant mothers exposed to pesticides are more likely to have preterm births and low birth weight, children with motor development problems, as well as children who go on to develop ADHD. These impacts are perhaps unsurprising given studies that show over 100 different chemicals detectable in pregnant women, including new or unknown compounds.

What to do: Pregnant women and households with young children are strongly encouraged to avoid all use or exposure to any pesticide products. Eating healthy, organic food is another factor that can reduce exposure and improve children's well-being. New and expecting families can find more resources to keep your home child-safe on the Materials for New Parents webpage. For more information on the range of diseases associated with pesticide use, see Beyond Pesticides' Pesticide Induced Diseases Database.

SOURCE: Utsunomiya, T., Taniguchi, N., Taniguchi, Y. *et al.* Association between maternal insecticide use and otitis media in one-year-old children in the Japan Environment and Children's Study. *Sci Rep* 12, 1365 (2022). https://doi.org/10.1038/s41598-022-05433-2 Image Source: Luca Prasso, Flikr

CHILDREN'S HEALTH | RESPIRATORY DISEASE | MARCH 3, 2022

Study Confirms Children's Exposure to Mosquito Pesticides Increases Risk of Respiratory Disease

Children's exposure to synthetic pyrethroid insecticides, particularly during the course of mosquito control operations, is associated with increased occurrence of certain respiratory diseases, finds research published in the journal *Thorax* in February. With a respiratory virus pandemic continuing to spread throughout the world, it has become increasingly important to avoid environmental exposures that can harm lung health. This research underscores the critical need for homeowners, farmers, and vector control officials to shift away from chemical use as the first line of defense against pest problems in order to safeguard children's health.

A total of 303 women and their children participated in the study, which tracked pesticide exposure during pregnancy and then at age five. All participants in the study lived within roughly three miles of a banana plantation. A structured questionnaire captured a range of variables, from socioeconomic status to medical history, local environmental conditions, occupation, and demographics. Researchers collected urine samples from pregnant mothers during the first visit, and their children during the five-year follow-up.

Urine samples were analyzed for metabolites concerning a range of insecticides, including chlorpyrifos, synthetic pyrethroids, the fungicides mancozeb, pyrimethanil, and thiabendazole, and

the herbicide 2,4-D. During the second follow-up, mothers filled out another questionnaire regarding their children's respiratory and allergic outcomes.

Of the pesticides tested, 80% are frequently detected within tested mothers, and 68% within children during the course of the study. Researchers thus differentiated between high and low levels of pesticide concentration in making their findings.

Current pesticide use is associated with a range of respiratory and allergic complications in children. High levels of metabolites from the fungicide mancozeb are correlated with increased incidence of lower respiratory tract infections. However, synthetic pyrethroid insecticides are the primary offenders, associated with higher rates of current asthma, passed asthma diagnosis, recent lower respiratory tract infections, and cough. The strongest association between pyrethroids and adverse health impacts is for wheeze. Increased exposure exhibits stronger correlations, with each 10x increase showing a greater likelihood of developing asthma, wheeze, lower respiratory tract infections, and itchy rash.

Data on the link between pesticide exposure and respiratory harms, particularly in children, have grown over the last decade. While researchers did not find links between prenatal pyrethroid use and childhood respiratory problems, a 2012 study looking at PBO (piperonyl butoxide), a pesticide "synergist" often combined with synthetic pyrethroids in consumer products was found to be linked to childhood cough after a mother's exposure. In 2015, a study at the University of California, Berkeley found that general exposure to organophosphates (not only chlorpyrifos) corresponds with a measurable decrease in lung function.

Data on the link between pesticide exposure and respiratory harms, particularly in children, have grown over the last decade.

Agricultural workers and their families are at greatest risk from these health hazards. A 2016 study linked an astounding 78 pesticides to allergic and non-allergic wheeze among male farmers. Agricultural work with toxic pesticides was associated with an increased risk of the potentially deadly diseases idiopathic pulmonary fibrosis (IPF) in a 2021 study, and chronic obstructive pulmonary disease (COPD) in a recent February 2022 report. Unsurprisingly, a comprehensive literature review published in 2020 finds pesticide exposure to be strongly correlated with the development of respiratory diseases.

What to do: Current laws do not adequately protect local residents from toxic pesticide exposure coming from farms, community and school pesticide use, and mosquito control operations. Through collective action, we can stop the regular use of hazardous, lung-harming pesticides in homes, on farms, and in mosquito management. Reach out to Beyond Pesticides for assistance with your local advocacy efforts. For more information about the link between pesticides and respiratory health, see Beyond Pesticides Pesticide-Induced Diseases Database.

SOURCE: Islam JY, Hoppin J, Mora AM, *et al.* Respiratory and allergic outcomes among 5-year-old children exposed to pesticides. *Thorax* 2023;78:41-49.

CHILDREN'S HEALTH | OXIDATIVE STRESS, DNA DAMAGE, AND CANCER | APRIL 28, 2022

Glyphosate Breakdown Product Associated with Oxidative Stress and DNA Damage Among Children

A study in *Environmental Research* finds that the herbicide glyphosate's primary metabolite (breakdown product), aminomethylphosphonic acid (AMPA), induces DNA damage through oxidative stress among subpopulations of primary school children. Although pyrethroid and chlorpyrifos metabolites can induce oxidative stress, this study is the first to investigate AMPA's association with adverse health effects, rather than solely the effects of the active ingredient, glyphosate, in Roundup and other formulations.

Glyphosate is the most commonly used active ingredient worldwide, appearing in many herbicide formulations, readily contaminating soil, water, food, and other resources. Chemical use has been increasing since the inception of crops genetically modified to tolerate glyphosate. However, studies demonstrate glyphosate is among the most prevalent pesticide contributors to human, biotic, and ecosystem harm.

According to research, herbicide toxicity to invertebrates has doubled since 2004. Although research links glyphosate exposure to cancer, specifically non-Hodgkin lymphoma, much less research considers the effects that metabolites have on children who are more vulnerable to chemical exposure. Ecological and health risk assessments primarily focus on active ingredients in pesticide products, overlooking the potential impacts of metabolites. Thus, studies like these highlight the need to assess the implications of metabolite exposure to protect human, animal, and environmental health. The study notes, "Our results indicate that [Cypriot] children are co-exposed to a mixture of pesticides likely originating from both dietary and non-dietary sources. On average, these pesticide exposures appear at higher levels than those typically measured in other EU (European Union) populations. The population health risk associated with such mixture exposures needs to be further investigated."

The researchers in this study investigated the health of children aged 10 to 11 in Cyprus, using the European Human Biomonitoring Initiative (HBM4EU) to measure urinary concentrations of glyphosate, AMPA, and pyrethroid and chlorpyrifos metabolites. Using an immunological assay, researchers identified oxidative stress using biological markers to assess lipid and DNA damage. Additionally, parents filled out questionnaires gathering data on demographic characteristics, pesticide usage, and diet.

The results find that AMPA, but not glyphosate, has a positive association with DNA damage via oxidation. Moreover, the metabolites of pyrethroids (3-PBA) and chlorpyrifos (TCPy) are also associated with DNA damage and oxidative stress. Lipid damage from oxidative stress did not occur among these pesticides. However, the results

suggest parental education levels influence urinary pyrethroid levels.

Decades of extensive glyphosate herbicide use (e.g., Roundup) have put human, animal, and environmental health at risk. The chemical's ubiquity threatens 93 percent of all U.S. endangered species, resulting in biodiversity loss and ecosystem disruption (e.g., soil erosion, loss of services, and trophic cascades). Exposure to glyphosate has implications for the development of various health anomalies, including cancer, Parkinson's disease, and autism. Although the U.S. Environmental Protection Agency (EPA) classifies glyphosate herbicides as "not likely to be carcinogenic to humans," stark evidence demonstrates links to various cancers, including non-Hodgkin lymphoma. EPA's classification perpetuates adverse impacts, especially among vulnerable individuals, like pregnant women, infants, children, and the elderly. Not only do health officials warn that continuous use of glyphosate will perpetuate adverse health effects, but that use also highlights recent concerns over antibiotic resistance. Agrochemical company Bayer/Monsanto patents glyphosate as an antibiotic. Exposure hinders enzymatic pathways in many bacteria and parasites. However, studies find glyphosate exposure disrupts the microbial composition in both soil and animals—including humans—discerningly eliminating beneficial bacteria while preserving unhealthy microbes. Moreover, resistance to pesticides is also growing at similar rates among genetically engineered (GE) and non-GE chemically grown crops. This increase in resistance is evident among herbicide-tolerant GE crops, including seeds genetically engineered to be glyphosate-tolerant.

This study is one of the first to identify oxidative stress from AMPA exposure among children in a nonoccupational setting. However, glyphosate and its formulations have long been associated with oxidative stress and strong evidence of genotoxicity. Moreover, glyphosate degrades relatively quickly in the environment, between five and 20 days, leaving behind AMPA, which is highly persistent with a half-life of 151 days. Therefore, researchers attribute higher rates of AMPA concentration in children's bodies to relative availability in the environment compared to glyphosate. Additional studies find that 100 percent of adults and children have detectable levels of AMPA in urine samples, with children exhibiting a five times higher bodily concentration than adults. Therefore, researchers suggest that a shift to organic can mitigate exposure to these toxic chemicals, especially among vulnerable populations like children.

It is essential to understand the effects widely used pesticides and their breakdown products may have on the health of current and future generations. Beyond Pesticides challenges the EPA registration of chemicals like glyphosate in court due to their impacts on soil, air, water, and our health. However, emphasis on converting to regenerative-organic systems and using least-toxic pest control can mitigate harmful exposure concerns. Public policy must advance this shift rather than continue to allow unnecessary reliance on pesticides.

What to do: Purchasing organic food whenever possible—which never allows glyphosate use—can help curb exposure and resulting adverse health effects. Beyond Pesticides provides tools, information, and support to take local action to stop glyphosate use and shift to organic practices: check out our factsheet on glyphosate/Roundup and our report, Monsanto's Roundup (Glyphosate) Exposed. Contact us for help with local efforts and stay informed of developments through our Daily News Blog and our journal, *Pesticides and You*. Additionally, check out Carey Gillam's talk on Monsanto's corruption on glyphosate/Roundup at Beyond Pesticides' 36th National Forum.

SOURCE: Konstantinos C. Makris, Nikolaos Efthymiou, Corina Konstantinou, Elena Anastasi, Greet Schoeters, Marike Kolossa-Gehring, Andromachi Katsonouri, Oxidative stress of glyphosate, AMPA and metabolites of pyrethroids and chlorpyrifos pesticides among primary school children in Cyprus, Environmental Research, Volume 212, Part B, 2022, 113316, ISSN 0013-9351, https://doi.org/10.1016/j.envres.2022.113316.

CHILDREN'S HEALTH | PEDIATRIC CANCER | JUNE 28, 2022

Pesticides Linked to Adult and Childhood Cancer in Western U.S., with Incidence Varying by County

There is a strong connection between pesticide use and cancer rates in the Western United States, finds research recently published by scientists at University of Idaho and Northern Arizona University. Two studies (here and here) published in the peer-reviewed journal *GeoHealth* used geospatial data and publicly available pesticide databases to uncover the relationship between chemical heavy agricultural practices and cancer in both adults and children. As the rate of chronic diseases like cancer continue to increase in the United States, and more and more studies find these diseases to be pesticide-induced, it is imperative for the public to put increased pressure on regulators and lawmakers to enact meaningful measures that eliminate pesticide use and the hazards these chemicals pose.

Of the two studies conducted by the research team, the first study models the connection between pesticide use and cancer incidence for adults and children in 11 western states (Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming), while the second study focuses on childhood cancer rates in Idaho's 44 counties. Both studies utilize databases established by public entities, including U.S. Geological Survey (USGS) Pesticide National Synthesis Project database, EPA Pesticide Industry Sales and Usage Estimates, National Cancer Institute (NCI) State Cancer Profiles, and the Cancer Data Registry of Idaho.

Rather than focus solely on the impacts of pesticide use to farmers or agricultural workers, the studies consider the broader effects of agricultural pesticide use on the public at-large.

For the first study, researchers take the top 25 most used pesticides identified by EPA estimates and cross-reference them with USGS data to determine the amount of each pesticide used by state and county. These data were then modeled against NCI county-level cancer incidence.

At the state level, an association is found between the total amount of all pesticides evaluated and both overall and pediatric cancer incidence. Delving deeper into specific pesticide types, a strong connection is found between the amount of fumigants applied in each state and the rate of pediatric cancers. Specifically, the fumigant pesticide metam sodium has a strong connection between its higher use and total cancer rate. These findings are even more prevalent at the county-level. A cutting edge model regarding fumigant use and cancer rate matches quite closely to currently observed cancer rates in the over 450 counties that comprise the 11 western states.

Notably, the areas where fumigant use is high are those with more vegetable and fruit production, rather than grain crops like corn and soy. Regarding the cancer connection to fumigant use, study coauthor Naveen Joseph, PhD says, "We have not seen it expressed in a fumigant like this before, and it's absolutely striking."

The second study by this research team likewise aimed to create a model able to describe county-level childhood cancer rates. Focusing in on Idaho's 44 counties, researchers this time used groundwater contamination, as recorded by the Idaho Department of Water Resources, as a variable and proxy for children's environmental exposures. The same 25 pesticides as the first study were reviewed, but researchers also include other environmental toxicants like heavy metals, and nitrate/nitrites. These data are consolidated into an Environmental Burden Index (EBI), and overall environmental contamination within each county is subsequently deemed as either low, medium, or high on the EBI.

The model finds that EBI correlates closely with the pediatric cancer rate. Idaho counties with high scores on the EBI have higher rates of childhood cancer. As the study further notes, "The variables predominantly contributing to the environmental burden index were pesticides." Like the first study, a model created by the researchers using these available data was able to accurately predict pediatric cancer incidence currently occurring in Idaho counties.

Geospatial mapping is providing new insights into the hazards presented by pesticide use, uncovering trends in public health that are systemic, yet rarely

considered. Case in point is a study published in 2020, which looks at the connection between Parkinson's disease, agricultural pesticide use, and one's zip code in Louisiana. That study found that Parkinson's rates are significantly higher in zip codes with commercial forests, woodlands, and pastures where the pesticides 2,4-D, chlorpyrifos, and paraquat were often sprayed.

As with other systemic injustices, one's zip code and place of residence often determines one's destiny. Uncovering this information and relating it to the public is of critical importance, but oftentimes those in disaffected communities are well aware of the dangers and threats they are exposed to daily. What is needed is action.

What to do: With pesticide use, we have enough evidence to know that we should be rapidly embracing time-tested, organic approaches to farming and land care that do not utilize toxic pesticides. Data elucidating the public health ills produced by pesticides must be accompanied by meaningful action from regulators and lawmakers at every level—local, state, and federal. For assistance in changing pesticide practices in your community, reach out to Beyond Pesticides at info@beyondpesticides.org

SOURCE: Joseph, N., Propper, C. R., Goebel, M., Henry, S., Roy, I., & Kolok, A. S. (2022). Investigation of relationships between the geospatial distribution of cancer incidence and estimated pesticide use in the U.S. West. *GeoHealth*, 6, e2021GH000544. https://doi.org/10.1029/2021GH000544; Joseph, N., & Kolok, A. S. (2022). Assessment of pediatric cancer and its relationship to environmental contaminants: An ecological study in Idaho. *GeoHealth*, 6, e2021GH000548. https://doi.org/10.1029/2021GH000548

CHILDREN'S HEALTH | CHILDHOOD DIABETES | AUGUST 5, 2022

Antibiotics and Neonicotinoid Insecticides Linked to Gut Microbiome Disruption and Childhood Diabetes

A study published in *World Journal of Pediatrics* finds an association between antibiotic and neonicotinoid (neonic) exposure and onset of pediatric (childhood) type 1 diabetes (T1D) through effects on the gut microbiome. Individuals with type 1 diabetes are at higher risk of other autoimmune disorders, including thyroid and celiac disease. Ample evidence demonstrates environmental contaminants like pesticides and antibiotics negatively affect human mouth and gut microbes. Health officials identify Type 1 diabetes as one of the most common chronic childhood diseases, increasing among children younger than five years old.

Through the gut biome, pesticide exposure can enhance or exacerbate the adverse effects of additional environmental toxicants on the body. Moreover, studies find low levels of pesticide exposure during pregnancy or childhood cause adverse health effects from

metabolic/immune disorders to mental and physical disabilities. Children are particularly vulnerable to the impacts of pesticide exposure as their developing bodies cannot adequately combat exposure effects. Although studies show how chemical exposures affect overall human health, more research is now questioning how these toxic chemicals influence gut health and subsequent occurrence of diseases. In children, gut microbiome disruption, or gut dysbiosis, has significant associations with type 1 diabetes development, and disruption of gut microbiota plays a role in type 2 diabetes development.

Over 11 percent (>37 million) of individuals in the U.S. have diabetes, and cases are growing by millions annually. With increasing rates of type 1 and 2 diabetes cases among the global population, studies like these highlight the importance of evaluating how chemical contaminants deregulate normal bodily function through microbiome changes.

There is a lack of understanding of the real-world effects of neonic and antibiotic exposure on gut microbiome changes akin to the onset of T1D. However, studies suggest the structure of gut microbiota in children can differ depending on the level of chemical exposure, leading to disparities in T1D risk. The study researchers highlight, "[M]ost existing studies on the health risks caused by antibiotics and pesticides tend to focus on the effect of high levels of exposure over short periods because relationships between long-term low-dose exposure and health risks are ambiguous and difficult to study. As a result, the mechanisms associated with their adverse effects on health remain unclear."

The researchers evaluate antibiotic and neonic concentrations in the urine of 51 children newly diagnosed with T1D, comparing chemical exposure levels to those of healthy control group children (without T1D). Mass spectrometry measured urine for concentrations of 28 antibiotics and 12 neonics, grouping children based on the type of chemical exposures. Furthermore, researchers compared gut microbiota in fecal matter to urine samples to determine a correlation between differences in gut microbiota and T1D onset.

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The study detects antibiotics in 72.5 percent of children with T1D and 61.2 percent of healthy children, while neonics are present in 70.6 percent of children with T1D and 52.2 percent of healthy children. A child's exposure to one type of antibiotic or two or more types of neonics increases the T1D risk 2.6 and 3.9-fold, respectively. Co-exposure to antibiotics and neonics has an association with T1D, increasing the risk 4.9-fold. Children unexposed to both antibiotics and neonics have a higher abundance of *Lachnospiraceae* (the core taxa of gut microbiota) than children exposed to antibiotics and neonicotinoids, alone or together.

The gut, also known as the "second brain," shares similar structural and chemical parallels with the brain. Microbiota (i.e., groups of microorganisms, including bacteria, archaea, viruses, and fungi) in the gut play a crucial role in lifelong digestion, detoxification, immune and central nervous system regulation, and other bodily functions. Through the gut biome, pesticide exposure can enhance or exacerbate the adverse effects of additional environmental toxicants on the body. Since the gut microbiome shapes metabolism, it can mediate some toxic effects of environmental chemicals. However, prolonged exposure to various environmental contaminants can induce critical chemical changes in the gut microbes, influencing adverse health outcomes.

The impacts of pesticides on the human gut microbiome represent another pesticide assault on human health as the biome harbors between 10 and 100 trillion symbiotic microbes. The human gastrointestinal tract and its digestive processes (the "gut") mediate the function of several systems. Dysfunction of the gut microbiome is associated with a host of diseases, including cardiovascular disease, some cancers, multiple sclerosis, diabetes, asthma, Crohn's disease, Parkinson's disease, and inflammatory bowel disease, as well as allergies, autism, depression, obesity, and other disorders or syndromes.

Over the past 20 years, neonicotinoids captured the global market of insecticides ahead of organophosphates, carbamates, phenyl-pyrazoles, and pyrethroids. These systemic agricultural pesticides are highly toxic, resembling nicotine and affect the central nervous system of insects, resulting in paralysis and death, even at low doses. Like other pesticides, neonics readily contaminate water and food resources as traditional water waste treatments typically fail to remove the chemical from tap water, and the systemic nature of neonics allows the chemical to accumulate within the product rather than externally. According to the Centers for Disease Control and Prevention (CDC), nearly half the U.S. population encounters at least one type of neonic daily, with children ages three to five having the highest exposure risk. Health impacts of exposure to neonics can include neurotoxicity, reproductive anomalies, hepatic and renal damage, and an increase in gene expression linked to hormone-dependent breast cancer. Additionally, researchers identified the role some neonicotinoids play in the production of an enzyme (aromatase) that stimulates excess estrogen

production, a known event in hormone-dependent cancer development.

Antibiotic exposure can allow more resilient bacteria to flourish in the gut microbiome and outcompete other beneficial bacteria. For instance, glyphosate, patented as an antibiotic by manufacturer Bayer/Monsanto, kills bacterial species beneficial to humans and incorporated in probiotics, yet allows harmful bacteria to persist, leading to resistance. Glyphosate's mode of action targets and inactivates an enzyme in the "shikimate [metabolic] pathway" in plants. Although this pathway is not present in animal cells, it exists among bacterial species. However, antibiotic exposure can still impact other metabolic pathways in animals. Antibiotic resistance can trigger longer-lasting infections, higher medical expenses, the need for more expensive or hazardous medications, and the inability to treat life-threatening illnesses.

The study concludes, "[C]hildren with exposure to antibiotics and neonicotinoids had small but critical changes in gut microbiota, characterize[ed} by a lower abundance of butyrate-producing genera, especially *Lachnospiraceae*. Similar changes were also observed in T1D children, which were thought to be associated with the increase of autoimmune level. These findings suggest that exposure to high levels of antibiotics and pesticides in daily life might increase the risk of autoimmune diseases, such as T1D. Future work should focus on relationships between antibiotics and neonicotinoids exposure and the onset of autoimmune diseases in children, as well as the underlying mechanisms."

Current risk assessment methods for pesticides are insufficient as assessment procedures fail to account fully for the sublethal effects of pesticides. With the globe currently going through the Holocene Extinction, Earth's 6th mass extinction, with one million species of plants and animals at risk over the last four decades, action is needed to mitigate our anthropogenic impact on essential ecosystem organisms.

Pesticides themselves can possess the ability to disrupt metabolic function, especially for chronically exposed individuals (e.g., farmworkers) or during critical windows of vulnerability and development (e.g., childhood, pregnancy).

What to do: It is essential to mitigate preventable exposure to disease-inducing pesticides. For more information on the effects of pesticide exposure on autoimmune and metabolic health, see Beyond Pesticides' Pesticide-Induced Diseases Database pages on diabetes, immune system disorders, endocrine disruption, and more. Replacing dietary exposure to food grown in chemical-intensive agriculture with organic consistently reduces pesticide levels in one's body. Preventive practices like organic can eliminate exposure to toxic autoimmune disrupting pesticides, like neonics. There is an indication that maintaining lower levels of conventional, synthetic pesticides is likely to reduce the risk of developing chronic diseases like type 2 diabetes. In addition to positive impacts on the human microbiome, organically grown food (i.e., milk, meat, strawberries, tomatoes, and a range of other foods) contain a much more diverse bacterial community than their chemically grown counterparts. Organic agriculture represents a safer, healthier approach to crop production that does not necessitate toxic pesticide use. Beyond Pesticides encourages farmers to embrace and consumers to support regenerative, organic practices. A complement to buying organic is contacting various organic farming organizations to learn more about what you can do. Additionally, learn more about the hazards posed to children's health through Beyond Pesticide's *Pesticide and You* Journal article, "Children and Pesticides Don't Mix."

SOURCE: Xu, ZR., Yuan, XX., Chen, RM. *et al.* Association between new onset type 1 diabetes and real-world antibiotics and neonicotinoids' exposure-related gut microbiota perturbation. *World J Pediatr* 18, 671–679 (2022). https://doi.org/10.1007/s12519-022-00589-3.

CHILDREN'S HEALTH | DEVELOPMENTAL DELAYS | SEPTEMBER 1, 2022

Exposure to Synthetic Pyrethroids During Infancy Associated with Developmental Delays in Toddlers

Low level exposure to synthetic pyrethroid insecticides at six to eight months of age is associated with language development delays in two-year old toddlers, according to research published in *Neurotoxicology* this month. This is the latest study to link this class of chemicals to developmental delays in young children. Despite a steady drumbeat of concerning research, the U.S. Environmental Protection Agency (EPA) in 2019 removed a crucial "safety factor" intended to protect children's health from synthetic pyrethroids, allowing higher levels of the insecticides to be sprayed on food, in homes, and playing fields around the country.

To investigate the impact of synthetic pyrethroids on language development, scientists enrolled 327 expectant mothers in their third trimester. The mothers, all from rural areas of China, were selected if they had no history of significant pesticide exposure or family history of serious disease. Urine samples were taken from the women during pregnancy,

and from infants 6-8 months after birth. Scientists analyzed samples for concentrations of three different synthetic pyrethroid breakdown products (metabolites), including 3-phenoxybenzoic acid (3PBA), 4-fluoro-3-phenoxybenzoic acid (4F3PBA), and cis-2,2dibromovinyl-2,2-dimethylcyclopropane-1-carboxylic acid (DBCA). While 3PBA is a metabolite of many synthetic pyrethroids, 4F3PBA is a more specific metabolite of cypermethrin, and DBCA is a metabolite of deltamethrin. At two years of age, enrolled children were tested for expressive communication, receptive communication, and language composite scores.

Average urinary synthetic pyrethroid concentrations in children aged six to eight months are found to be higher than those taken from their mothers during pregnancy for metabolites 3PBA and 4F3PBA. The cyfluthrin metabolite 4F3PBA correlates with lower receptive communication scores. Every one microgram increase in 4F3PBA exposure during infancy corresponds with a 9% increased chance of not passing the receptive communication test. Yet the strongest association is seen with the deltamethrin metabolite DBCA, which is found to increase risk of language development delay by 4.58 times. This metabolite also increases risk of not passing expressive communication tests by 21%. Young boys in particular experience a statistically significant impact compared to young girls, associated with overall exposure to pyrethroid metabolites. Higher amounts of pesticide metabolites in infant boy's urine is associated with lower scores for receptive communication and language composite tests. The study concludes that, "The probability of toddlers' language development delay may be predicted by PYRs [pyrethroids] metabolites of infants aged 6–8 months."

After EPA identified risks of concerns to children over six months and under six years old from exposure to synthetic pyrethroids, the major manufacturers of the insecticides coordinated under the Council for the Advancement of Pyrethroid Human Risk Assessment (CAPHRA) to come up with a new evaluation process for the impact of pyrethroids on children's health. Unsurprisingly, the model developed by CAPHRA effectively exonerated synthetic pyrethroids from harmful effects, allowing the removal of the childhood safety factor and an explosion in pyrethroid usage. Notwithstanding the risks to children in this age range, EPA did not even entertain the potential for damaging impacts to occur earlier in life. In its reevaluation of the safety factor, the agency wrote, "Furthermore, fetal exposure and exposures to children below six months of age are expected to be negligible because pyrethroid levels in food and drinking water are generally low and there is no or low potential for contact with treated surfaces. After looking at hundreds of peer-reviewed studies in the independent scientific literature, EPA incorporated only two into its determination.

Numerous studies have linked synthetic pyrethroids to developmental harm in children. A 2011 study found that children exposed to higher levels of synthetic pyrethroids are three times as likely to have mental delay compared to less exposed children. A 2014 study associated proximity to pesticide treated agricultural fields in pregnancy to increased risk of autism to children of exposed mothers. Two studies published in 2015 find that deltamethrin increases risk of ADHD in children, with one study finding impacts specifically to boys.

Studies published in 2017 found that synthetic pyrethroid exposure increases risk of premature puberty in boys, and another associated the chemicals with externalizing and internalizing disorders. The impacts seen are not all developmental. A 2012 study associates pyrethroid exposure before, during, and after pregnancy with increased risk of infant leukemia. And a 2022 finds that synthetic pyrethroid exposure during mosquito control operations increases risk of respiratory disease and certain allergies.

What to do: We must embrace a precautionary approach to pesticide regulation, placing the onus on pesticide manufacturers to prove safety rather than on regulators to prove harm. If peer-reviewed studies indicate the potential for harm to children's health, the precautionary approach rejects this harm in favor of available alternatives. Join in urging U.S. Senators to cosponsor the *Protect America's Children From Toxic Pesticides Act*, which would make significant progress in reining in the influence of the pesticide industry at EPA. Learn how to use science in advocacy in community decision making to eliminate toxic pesticide use by viewing the 2022 National Pesticide Forum Series, Health, Biodiversity, and Climate: A Path for a Livable Future.

SOURCE: Chen S, Xiao X, Qi Z, Chen L, Chen Y, Xu L, Zhang L, Song X, Li Y. Effects of prenatal and infant daily exposure to pyrethroid pesticides on the language development of 2-year-old toddlers: A prospective cohort study in rural Yunnan, China. Neurotoxicology. 2022 Sep;92:180-190. DOI: 10.1016/j.neuro.2022.08.002

CHILDREN'S HEALTH | BIOMONITORING OF PREGNANT WOMEN | SEPTEMBER 2, 2022

Compounds in Pesticides Shown to Harm Fetuses and Children with Disproportionate Risk to People of Color

Revelations of toxic risks to pregnant people seem to emerge with alarming frequency. In late August a study published in *Chemosphere* finds that the compound melamine, its primary byproduct (cyanuric acid), and four aromatic amines were detected in the urine of nearly all pregnant research participants. These chemicals are associated with increased risks of cancer, kidney toxicity, and/or developmental harm to the resultant child. Beyond Pesticides has covered a variety of pregnancy risks from pesticides and other toxic chemicals, including these in just the last three years: pesticides and children's sleep disorders; prenatal exposures to a multitude of chemicals; insecticides and childhood leukemia; insecticides and Attention Deficit/Hyperactivity Disorder.

Those of a certain age may hear "Melamine" and think of the nearly indestructible plastic dinnerware from

the mid-20th century, but "melamine" is an organic chemical compound that, when combined with formaldehyde, forms a durable plastic. Others may remember the 2007–2008 incident in China of contamination of infant formula with melamine, which resulted in six deaths, and kidney and urinary tract harms (ranging from development of kidney stones to acute renal failure) in some 300,000 babies. [A small sidebar explainer: melamine was actually intentionally added to the formula under the notion that it would boost the protein content. And because melamine is a high-nitrogen compound, and the chief test for protein levels at the time assayed nitrogen content, the (false) assumption of more protein, as well as the fact that it is a cheap chemical, drove that tragic and toxic decision.]

After the infant formula incident and others involving melamine-contaminated pet food, the compound was recognized as a kidney toxicant. Yet melamine is found in many commercial products, including synthetic pesticides and fertilizers, dishware, plastics, flooring, cookware, kitchen counters, and others. Cyanuric acid is used as a swimming pool cleaning solvent, disinfectant, and plastic stabilizer; aromatic amines are found in hair coloring, mascara, tattoo ink, paint, tobacco smoke, and diesel exhaust.

Many of these compounds are also used in industrial applications, such as in rubbers, adhesives, oil refining, synthetic polymers, dyes, perfumes, pharmaceuticals, and explosives. Exposures to melamine, cyanuric acid, and aromatic amines can happen via any of multiple vectors that can be contaminated with these compounds; people encounter them by consuming food, breathing air, ingesting household dust, drinking water, or using products that contain plastics or pigments.

The research team, hailing largely from the University of California San Francisco (UCSF) and Johns Hopkins Bloomberg School of Public Health, measured 45 chemicals associated with cancer and other risks, using methods that can capture chemicals, or even traces of them, in urine samples. The sampling period extended from 2008 to 2020, though the bulk of collection happened from 2017 to 2020. Samples were collected across all three trimesters of pregnancy. The subjects comprised a group of 171 women—from New York, New Hampshire, Puerto Rico, California, Illinois, and Georgia—who are part of the National Institutes of Health's (NIH's) Environmental influences on Child Health Outcomes (ECHO) Program.

Not only are these inequities in exposures and body burdens of concern for the women, but also, the presence of these compounds in their bodies during pregnancy raises further alarm for the babies that come of those pregnancies. Because the mothers have been exposed prenatally, there may be a real risk of subsequent developmental impacts.

These participants were, on average, 29.5 years old, and represented a relatively diverse sample of the population: 20% were Black, 34% were White, 40% were Latina, 4% were Asian, and 3% were from other or multiple demographic groups. The study authors note that this is "the largest U.S. study to date of melamine, melamine derivatives, and aromatic amines in a geographically and demographically diverse population of pregnant women," and that previous research on melamine has focused on pregnant women in Asian countries, or been limited to non-pregnant people in the U.S.

More than 60% of the samples show the presence of 12 of the 45 chemicals for which the study looked; five were detected in nearly every sample. Melamine, cyanuric acid, *and* nine aromatic amines show up in more than half of the study participants. Most chemicals found are associated with higher exposures among Black and Hispanic participants, as compared with non-Hispanic whites. The highest levels of melamine and cyanuric acid are found in women of color and those with greater exposure to tobacco. In another example, the levels of 3,4-dichloroaniline (used in the production of dyes and pesticides) are more than 100% higher among Black and Hispanic women than in white women.

Not only are these inequities in exposures and body burdens of concern for the women, but also, the presence of these compounds in their bodies during pregnancy raises further alarm for the babies that come of those pregnancies. Because the mothers have been exposed prenatally, there may be a real risk of subsequent developmental impacts, both because there is the potential for maternal–fetal transfer of toxic chemicals via the placenta and/or breastmilk, and because children may have particular "windows" of developmental vulnerability to any one (or more) of these chemicals. Some animal studies have pointed, for example, to fetal growth restriction, incomplete bone development, and spatial cognitive impairments following exposures to melamine (or its analogs, ammeline, ammelide, and cyanuric acid). Further peril lies in the possibility, as the study authors say, that there could be "synergistic effects . . . when exposed to both melamine and melamine analogs."

Study co-senior author Jessie Buckley, PhD, associate professor at Johns Hopkins Bloomberg School of Public Health, commented: "It's disconcerting that we continue to find higher levels of many of these harmful chemicals in people of color." Johns Hopkins postdoctoral fellow and study coauthor Giehae Choi said, "Our findings raise concerns for the health of pregnant women and fetuses, since some of these chemicals are known carcinogens and potential developmental toxicants. Regulatory action is clearly needed to limit exposure." And study co-senior author and professor of obstetrics, gynecology, and reproductive medicine (and director of the UCSF Program on Reproductive

Health and the Environment) Tracey J. Woodruff, PhD, added, "These chemicals are of serious concern due to their links to cancer and developmental toxicity, yet they are not routinely monitored in the United States."

The research paper explains, "Our data indicate important differences in exposures by race and ethnicity; evaluating potential sources of exposure that may contribute to these inequities is needed. Our larger follow-up study will allow us to better characterize exposures across the U.S. during a critical period of development and further assess influential predictors and demographic differences that we characterized in this initial study. Finally, our study demonstrates the importance of continuous identification of environmental factors that can play an important role in maternal and child health." It concludes that there is critical and broad need for expanded biomonitoring that can identify sources of exposure disparities by race and/or ethnicity, and evaluate potentially harmful health effects.

Beyond Pesticides spends a good deal of its human capacity sharing information on the very broad and harmful impacts of the use of synthetic pesticides (and other toxic chemical compounds). The research on these compounds is widely appreciated, and yet, Beyond Pesticides has asserted: the state of pesticide regulation, and of research into pesticide impacts, is inadequate and like nothing so much as a game of "whack-a-mole." A single pesticide or class of pesticides is studied, a paper is written, and policymakers and regulators may or may not pay attention. Then another one happens, and another, and another, ad infinitum.

The pattern of "progress" is similar on the regulation side: individual pesticides registered (aka, approved) by the U.S. Environmental Protection Agency (EPA) are reviewed "on the regular—but only every 15 years, barring an emergent and urgent concern. Given the cascade of discovery of harmful impacts over the past couple of decades, 15 years has become a very long window in which to allow continued use for lack of review.

When there is an urgent concern, EPA may undertake more timely review, but again, one compound at a time. Even more fundamentally, its approach to regulation, in the face of evidence of harm, is often characterized by tweaking the use of toxic pesticides "at the margins"—requiring a change to the text on a pesticide label, reducing the time frame in which a compound can be used, restricting application to trained applicators, or other piecemeal actions that are generally wholly inadequate to reducing the health and environmental harms of these compounds being unleashed into the environment.

EPA also continues to fall short on multiple research and regulatory fronts: looking carefully at synergistic impacts, multiple exposure vectors, and endocrine disruption effects, among others. In addition, the agency is far too dependent on industry-generated research, influenced by agrochemical industry lobbying, and sometimes, in downright cahoots with industry.

What Beyond Pesticides wrote in 2020 holds: "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 . . . given the availability of organic systems . . . [to] eliminate those hazards economically and solve the looming environmental threats."

Likewise still relevant is a 2019 Daily News Blog article, in which Beyond Pesticides wrote, "Since Rachel Carson stunned the world and ignited the modern environmental movement with [her groundbreaking book,] *Silent Spring* [60 years ago this year], pesticide regulation has been stuck in a whack-a-mole approach that targets only the most publicly visible, toxic, and researched chemicals for restrictions. By transitioning to organic, not only in food production, but also in the management of pests in lawns and landscapes, and other pest control practices, we can eliminate the broad range of chemicals linked to diseases that are all too common in today's world, and truly protect public health, wildlife, and the environment."

Beyond Pesticides spends a good deal of its human capacity sharing information on the impacts of synthetic pesticides. And yet, it has asserted—the state of pesticide regulation, and of research into pesticide impacts, is inadequate and like nothing so much as a game of "whack-a-mole."

What to do: Beyond Pesticides continues work on its mission—to transform the nation's approach to pest management in all sectors (agricultural, residential/structural, and broad land management) by eliminating the current dependency on pesticides and advancing organic regenerative approaches that do not rely on toxic inputs. The subject research adds to the evidence supporting our call to eliminate use of synthetic, fossil-fuel-based pesticides within the next decade. With sufficient public engagement and advocacy, combined with the work of health, environment, and biodiversity organizations, we can put a stop to toxic pesticide exposures and embrace an organic systems approach that is precautionary and protective of all that we hold dear.

SOURCES: Giehae Choi, Jordan R. Kuiper, Deborah H. Bennett, Emily S. Barrett, Theresa M. Bastain, Carrie V. Breton, Sridhar Chinthakindi, Anne L. Dunlop, Shohreh F. Farzan, Julie B. Herbstman, Margaret R. Karagas, Carmen J. Marsit, John D. Meeker, Rachel Morello-Frosch, Thomas G. O'Connor, Edo D. Pellizzari, Megan E. Romano, Sheela Sathyanarayana, Susan Schantz Rebecca J. Schmidt, Deborah J. Watkins, Hongkai Zhu, Kurunthachalam Kannan, Jessie P. Buckley, Tracey J. Woodruff, Exposure to melamine and its derivatives and aromatic amines among pregnant women in the United States: The ECHO Program, Chemosphere, Volume 307, Part 2, 2022, 135599, ISSN 0045-6535, https://doi.org/10.1016/j.chemosphere.2022.135599; AAAS press release

CHILDREN'S HEALTH | KIDNEY CANCER | NOVEMBER 10, 2022

Kids and Kidney Cancer: Implication for Prenatal Pesticide Exposure

A meta-analysis by University Alberta Hospital, Edmonton, AB, Canada adds to the plethora of research linking prenatal (before birth/during pregnancy) pesticide exposure to carcinogenic (cancer) tumor development. The analysis, published in *Human & Experimental Toxicology*, finds parental exposure to pesticides during the preconception (before pregnancy) or pregnancy period increases the risk of Wilms' tumor (a type of kidney cancer) occurrence among children. Already, studies find low levels of pesticide exposure during pregnancy or childhood cause adverse health effects, from metabolic disorders to mental and physical disabilities. Although medical advancements in disease survival are more prominent nowadays, childhood cancer remains the leading cause of death from disease among children. Furthermore, childhood cancer survivors can suffer from chronic or long-term health complications that may be life-threatening.

Children are particularly vulnerable to the impacts of pesticide exposure, as their developing bodies cannot adequately combat exposure effects. Moreover, a pregnant woman's pesticide exposure can have a stronger association with childhood cancer than a child's exposure. Therefore, it is essential to understand how pesticides impact the health and well-being of individuals during critical developmental periods, especially for latent diseases (e.g., cancers).

The researchers performed a systematic review and meta-analysis on case-control studies to determine a link between pesticide exposure and Wilms' tumor occurrence in children. To establish the connection, researchers used monographs (commentary studies) on specific organophosphate insecticides and herbicides from the International Association for the Research on Cancer (IARC) of the World Health Organization (WHO). Researchers systematically reviewed PUBMED, SCOPUS, and Google Scholar studies (1960–2021) following the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines.

The report also examines occupational versus residential exposure and before-birth (prenatal) versus after-birth (postnatal) exposure. These results strengthen the finding that parental pesticide exposure before or during pregnancy correlates with increased risk for Wilms' tumor in a child. The IRAC/WHO monographs support this conclusion and policies to stop specific pesticide use to prevent future cases of cancer.

The connection between pesticides and cancer is significant as several studies link pesticide use and residues to the illness (e.g., breast cancer, prostate cancer, lung cancer). Sixty-six percent of all cancers have links to environmental factors, especially in occupations of high chemical use. In addition to links between agricultural practices and pesticide-related illnesses, over 65 percent of commonly used lawn pesticides and 70 percent of commonly used school pesticides have links to cancer. Moreover, a 2021 study finds previous

maternal exposure to the chemical compound during pregnancy can increase the risk of breast cancer and cardiometabolic disorders (e.g., heart disease, obesity, diabetes) up to three times in successive generations.

This study reinforces the concept of "critical windows of exposure," which suggests that prenatal and early-life exposure to environmental toxicants increase susceptibility to health impacts. While Wilms' tumor generally afflicts children under ten years of age, other early life exposures can take years and even decades before adverse health effects arise. Although 90 percent of kidney tumors among children are Wilms tumors, co-occurring diseases may arise from weakened immune function. Similar to this study, previous research demonstrates that pregnant mothers' exposure to household cleaners, many of which are pesticides, can increase nephroblastoma (kidney cancer) and brain tumor risk in children. The etiology or cause of childhood cancer involves the interaction of multiple components including lifestyle and genetics. However, emerging evidence indicates that environmental contaminants like pesticides (through occupational exposures, air pollution, pesticides, solvents, diet, etc.) play a role in disease etiology. Pesticide contamination is widespread in all ecosystems, and chemical compounds can accumulate in human tissues resulting in chronic health effects. The study concludes, "Pesticide exposure in household/residential settings seems to contribute to Wilms' tumor etiology. Additional investigations with an extensive sample size are required to conclude more confidently, probably involving low-/middle-income and high-income countries. This may be considered important in the post-pandemic era. In our opinion, there is some compelling evidence to robustly educate parents and/or guardians more regarding the appropriate use of chemical compounds and take necessary precautions to minimize the potential risks associated with their application."

There is a strong consensus among pediatricians that pregnant mothers and young children should avoid pesticide exposure during critical windows of development. The wide availability of non-pesticidal alternative strategies allows for choices in residential and agricultural management to promote a safe and healthy environment, especially among chemically vulnerable individuals. For instance, buying, growing, and supporting organic land management reduces human and environmental contamination from pesticides. Organic agriculture has many health and environmental benefits, which curtail the need for chemical-intensive agricultural practices. Numerous studies find that pesticide metabolite levels in urine significantly decrease when switching to an all-organic diet.

What to do: For more information on how organic is the right choice for both consumers and the farmworkers who grow our food, see the Beyond Pesticides webpage on the Health Benefits of Organic Agriculture. On hazards posed to children, see the Pesticide-Induced Diseases Database (PIDD) pages on cancer, birth/fetal defects, and other diseases.

SOURCE: Khan A, Feulefack J, Sergi C. Exposure to pesticides and pediatric Wilms' tumor. A meta-analysis on pre-conception and pregnancy parental exposure with an IARC/WHO commentary. *Human & Experimental Toxicology*. 2022;41. doi:10.1177/09603271221136211

CHILDREN'S HEALTH | EARLY ONSET PUBERTY | DECEMBER 8, 2022

Childhood Pesticide Exposure Associated with Early Onset of Puberty

Children with higher levels of certain pesticide metabolites are more likely to go through early puberty, according to research published in *Environmental Pollution*. The findings by a team of Spanish researchers speak to a need for greater protections for children from toxic pesticide exposure. Children are much more sensitive to pesticide exposure than adults as they take in greater amounts of toxic substances relative to their body weight and have developing organ systems.

Researchers began their investigation with children, ages 7–11, participating in the Spanish state's environment and childhood multicenter birth cohort study, an ongoing project aimed at understanding the effect of environmental exposures on pregnancy, fetal, and childhood development in the country. Out of over 3,000 children enrolled in the project, 1,539 had their urine sampled for the presence of pesticide metabolites. Scientists focused on four insecticides breakdown products—a chlorpyrifos metabolite "TCPy," a metabolite of the organophosphate diazinon "IMPy," a general organophosphate metabolite "DETP," the pyrethroid metabolite "3-PB," and a metabolite of ethylene-bis-dithiocarbamate fungicides "ETU." Urinary levels of these

Children are much more sensitive to pesticide exposure than adults as they take in greater amounts of toxic substances relative to their body weight and have developing organ systems.

pesticide metabolites were then compared with parental-reported stages of pubertal development. Researchers worked to control for confounders, and did explore the further interaction between pubertal development, chemical exposure, and body mass index.

For girls, urinary concentrations of DETP and ETU above the 75th percentile are associated with a greater chance of pubertal development, with ETU fungicide metabolites specifically resulting in greater development among girls who are underweight or normal weight (with odds ratios averaging a 10x increased risk). For boys, any detection of TCPy influences more rapid genital development than boys without evidence of exposure. 3-PBA and ETU above the 75th percentile in boys is associated with greater development in overweight/obese and underweight/normal weight children, respectively. Interestingly, DETP was found to be associated with lower odds of pubertal development in overweight/obese boys. "[T]hese findings represent a potential cause of concern, due to the widespread exposure to children in the general population to pesticides and the possibility that altered pubertal timing may increase the risks of behavioral disorders during adolescence and of obesity, cardiovascular disease, and endocrine-related cancers later in life," the authors write.

"[T]hese findings represent a potential cause of concern, due to the widespread exposure to children in the general population to pesticides and the possibility that altered pubertal timing may increase the risks of behavioral disorders during adolescence and of obesity, cardiovascular disease, and endocrine-related cancers later in life," the authors write.

This area of research has been developing consistently since the turn of the century. In 2008, a study on the synthetic pyrethroid esfenvalerate found that it delays the onset of puberty in rats at doses as much as two times lower than levels EPA classifies as having no adverse effects. Nearly a decade later, another study on synthetic pyrethroids, this time looking directly at the association between urinary levels and puberty onset, found similar results with the insecticide cypermethrin. Not only did this study find an association, it was able to characterize the effects driving the process. In rodent models, researchers find that cypermethrin is accelerating puberty through hormonal release. Rather than a response from the hypothalamus, which controls the release of pituitary luteinizing (affecting the reproductive system) and follicle-stimulating hormones, scientists find that cypermethrin acts directly on cells within the testis and pituitary glands.

What to do: Encourage schools to serve organic food, and work to eliminate the unnecessary use of toxic pesticides on community lawns and landscapes.

SOURCE: Castiello F, Suárez B, Beneito A, Lopez-Espinosa MJ, Santa-Marina L, Lertxundi A, Tardón A, Riaño-Galán I, Casas M, Vrijheid M, Olea N, Fernández MF, Freire C. Childhood exposure to non-persistent pesticides and pubertal development in Spanish girls and boys: Evidence from the INMA (Environment and Childhood) cohort. Environ Pollut. 2023 Jan 1;316 (Pt 2):120571. DOI: 10.1016/j.envpol.2022.120571.

CHILDREN'S HEALTH | AUTISM | DECEMBER 20, 2022

Mother and Child Health: Learning Disorders and Prenatal Pesticide Exposure Study Results Released

A meta-analysis published in *Chemosphere* finds prenatal pesticide exposure, or pesticide exposure during pregnancy has a positive association with autism spectrum disorder (ASD) and attention deficit/hyperactive disorder (ADHD). Particularly, exposure to the organophosphate (OP) and pyrethroid (PYR) insecticides, in addition to the mother's age during pregnancy (≥30 years old), increased the risk factor of ASD. ADHD risk increases among offspring whose mothers encountered organochlorine pesticides (OCPs) during gestation. The etiology or cause of ASD and ADHD involves the interaction of multiple components, including lifestyle and genetics. However, emerging evidence indicates that environmental contaminants like pesticides play a role in disease etiology.

While it is a complex disease, and genetics may play a role, no specific genes have been identified, and there is increasing evidence that environmental factors like pesticide exposure facilitate the development of the condition. ADHD is estimated to affect 8–12% of school-age children worldwide. The U.S. Centers for Disease Control and Prevention (CDC) estimates that 1 in 54 children have been diagnosed with an autism spectrum disorder. Rates of autism have skyrocketed over the last several decades. While some of the rise is due to the increase in testing, and an expansion of the diagnostic criteria for the disorder, this cannot entirely account for the increase in ASD cases. In 1997, 0.1% of children had autism, while in 2010, that number rose to 1%. Considering several studies associate early-life exposure to toxic chemicals with adverse birth/health effects, additional exposure through maternal contamination poses an even greater risk to children's health. The report notes, "The findings indicate that maternal pesticide exposure should be avoided, especially for older pregnant women in agricultural areas, to protect early brain development in offspring."

Beyond Pesticides has covered a variety of pregnancy risks from pesticides and other toxic chemicals, including these in just the last three years: pesticides and children's sleep disorders; prenatal exposures to a multitude of chemicals; insecticides and childhood leukemia; and, insecticides and Attention Deficit/Hyperactivity Disorder.

The analysis reviews documents from five databases (i.e., *PubMed, Embase, Web of Science, Medline, PsycINFO)* related to pesticide exposure during pregnancy and ASD and ADHD in children. Factors considered for ASD and ADHD risk include pesticide type, window of exposure, and mother's age. The review identifies, 949 studies, but opted to use the 19 studies with more robust information. There were 11 studies on ASD, seven studies on ADHD, and one study on both disorders. The analysis confirms that a mother's

exposure to pesticides increases offspring's risk of ASD and ADHD.

Pesticide exposure during pregnancy is of specific concern as health effects for all life stages can be long-lasting. Just as nutrients are transferable between mother and fetus, so are chemical contaminants. Studies find pesticide compounds present in the mother's blood can transfer to the fetus via the umbilical cord. Therefore, pesticide exposure during pregnancy has implications for both the mother and child's health. Many studies indicate prenatal and early-life exposure to environmental toxicants increases susceptibility to disease. A 2020 study finds the first few weeks of pregnancy are the most vulnerable periods during which prenatal exposure to pesticides can increase the risk of the rare fetal disorder holoprosencephaly. This disorder prevents the embryonic forebrain from developing into two separate hemispheres. Moreover, women living near agricultural areas experience higher exposure rates that increase the risk of birthing a baby with abnormalities, including cancers like acute lymphoblastic leukemia.

This determination, and the present study's findings, are supported by previous scientific literature. Similar to this study, a range of research demonstrates that pregnant mothers' exposure to specific pesticides has links to autism, evidenced by laboratory and epidemiological research. Scientific studies have consistently found elevated rates of ASD in areas of high pesticide use. A 2014 study from the University of California, Davis, found that pregnant women living near crops sprayed with organophosphates, like the insecticide chlorpyrifos, increases the chance of their child being diagnosed with ASD by 60%. For women in their second trimester, chlorpyrifos increases ASD odds by 3.3x. Synthetic pyrethroids increased autism risk by 87 percent. Like the aforementioned insecticides, fungicides also have links to autism disorders. A separate study from California researchers connects autism to the herbicide glyphosate, the banned-for-residential-use insecticide diazinon, the fumigant methyl bromide, and fungicide myclobutanil. Moreover, studies find that higher rates of ADHD have associations with direct exposure in children and pyrethroid metabolites found in children's urine. The Cincinnati Children's Hospital Medical Center found a strong association between urinary pyrethroid concentrations and ADHD, primarily in boys. Any concentrations found above the level of detection corresponded to a three-fold increase in the chance of developing ADHD when compared to boys without detectable levels. Another study from Rutgers University found that, of over 2,000 children who had ever received an ADHD diagnosis, children with higher urinary pyrethroid metabolite levels were more than twice as likely to be diagnosed with ADHD. The connection between pesticide exposure and learning/developmental disorders has much research. Although more research is needed to further define the connection, there is enough evidence to warrant a precautionary approach and restrictions on hazardous ASD and ADHD-linked pesticides. The study concludes, "Our findings contribute to our understanding of health risks related to maternal pesticide exposure and indicate that the in-utero developmental period is a vulnerable window-of-susceptibility for ASD and ADHD risk in offspring. These findings should guide policies that limit maternal exposure to pesticides, especially for pregnant women living in agricultural areas."

What to do: For more information on how organic is the right choice for both consumers and the farmworkers that grow our food, see the Beyond Pesticides webpage on the Health Benefits of Organic Agriculture.

SOURCE: Yifan Xu, Xu Yang, Danrong Chen, Yadan Xu, Linchen Lan, Shuangshuang Zhao, Qianqi Liu, Antoine M. Snijders, Yankai Xia, Maternal exposure to pesticides and autism or attention-deficit/hyperactivity disorders in offspring: A meta-analysis, Chemosphere,Volume 313, 2023, 137459, ISSN 0045-6535, https://doi.org/10.1016/j.chemosphere.2022.137459.

GUT MICROBIOME | DISINFECTANT/ANTIMICROBIAL AND INFLAMMATORY BOWEL DISEASE | JANUARY 25, 2022

Common Antimicrobial Pesticides Linked to Altered Gut Microbe Function

Research at the University of North Carolina at Chapel Hill identifies how triclosan (TCS), an antimicrobial agent used in many household products, impacts the microbial communities in the gut, causing inflammation. According to the study published in *Nature Communications*, triclosan worsens the effects of ulcerative colitis, an inflammatory bowel disease (IBD), through the retention of harmful bacteria. Ample evidence demonstrates environmental contaminants, including pesticides like triclosan, negatively affect microbes in the human mouth and gut. Although studies show how triclosan exposure affects human health, more research is now questioning how exposure to these toxic chemical influences gut health. Therefore, studies like these highlight the importance of evaluating how chemical contaminant deregulates normal bodily function through microbiome changes. Furthermore, the study has significant implications for considerations that should be, but are not currently, a part of pesticide review and registration by the U.S. Environmental Protection Agency (EPA). The researchers note, "Together, our results define a

mechanism by which intestinal microbes contribute to the metabolic activation and gut toxicity of TCS, and highlight the importance of considering the contributions of the gut microbiota in evaluating the toxic potential of environmental chemicals."

Instances of intestinal bowel disease (IBD)—involving the chronic inflammation of intestinal tissues—incidences and prevalence are readily increasing. As many as 3 million U.S. adults suffer from some form of IBD, with the year 1999 representing a 50 percent increase in disease cases. Disease symptoms include stomach pain, diarrhea, rectal bleeding, and an increased risk of developing colorectal cancer. IBD has no cure, and current treatments can have severe side effects. Although the study notes environmental chemical exposure has links to IBD prevalence, the researchers aim to uncover the mechanisms driving gut microbe disruption.

University researchers sought to identify the molecular mechanisms involved in triclosan's toxic effects on the gut. The scientists employed in vitro (artificial environmental), ex vivo (outside the organism), and in vivo (inside the organism) analyses on microbial communities in the gut of mice. Specifically, researchers investigated specific bacterial enzymes involved in triggering triclosan toxicity through metabolization. The study results find that microbial β-glucu-ronidase (GUS enzymes are responsible for metabolically activating triclosan within the colon, driving gut toxicity. Conversely, inhibition of this bacterial enzyme decreases the gut inflammatory effects of triclosan, thus showcasing the impact specific microbes play in chemical toxicity.

Gut microbiota plays a crucial role in lifelong digestion, immune, and central nervous system regulation, as well as other bodily functions. Through the gut biome, pesticide exposure can enhance or exacerbate the adverse effects of additional environmental toxicants on the body. Since the gut microbiome shapes metabolism, it can mediate some toxic effects of environmental chemicals. However, with prolonged exposure to various environmental contaminants, critical chemical-induced changes may occur in the gut microbes, influencing adverse health outcomes. Over 300 chemical contaminants and their by-products are common in human blood and urine samples. Most chemical contamination affecting the gut comes from a diet reliant on conventional, pesticide-laden, highly processed foods. In a 2020 study, researchers associated developmental defects, diabetes, cardiovascular disease, liver disease, obesity, thyroid disorders, and improper immune operation with changes to the gut after exposure to environmental contaminants. Despite the growing body of work linking gut bacteria to overall health, pesticide regulators generally overlook the concept. Therefore, regulators must consider the emerging science on the dangers of pesticides beyond the mortality of humans, animals, and plants to include overall health and fitness.

A bioinformatics tool developed by researchers from the University of Turku in Finland indicates that "54% of species in the core human gut microbiome are sensitive to glyphosate." (See Daily News.) Published in the *Journal of Hazardous Materials*, the researchers' paper states, "The widespread use of glyphosate may have a strong effect on gut microbiomes as well as on human health." Bats foraging in chemical-intensive banana plantations have much less gut diversity than bats foraging in organic banana fields and natural forestland, finds research published this month in the journal *Frontiers in Ecology and Evolution*. (See Daily News.)

Triclosan is an antimicrobial agent in products regulated by EPA and FDA. However, cumulative exposure to triclosan registered by both agencies poses unacceptable risks to human health and the environment. Many studies identify the various health and environmental effects of triclosan as the chemical absorbs through organs, from the skin to the gastrointestinal tract, and are environmentally persistent. Several independent, peer-reviewed research studies have identified triclosan as an endocrine-disrupting chemical. On top of its endocrine-disrupting effects, recent work shows that triclosan is a possible human carcinogen. Similar to this study, a 2016 peer-reviewed study published in the *Annual Review of Pharmacology and Toxicology* found that triclosan promotes cancer cell development in mice through pathways shared with humans. Furthermore, like many antimicrobial and antibacterial products, triclosan use increases the persistence of antibiotic-resistant bacteria, a severe public health concern for disease risk. Despite these findings, EPA's evaluation of triclosan fails to address one of the most concerning aspects of its chemical activity concerning human and environmental health.

While people who use triclosan products daily have higher concentrations in their bodies, consumers who do not use triclosan can still encounter the chemical through food, water, and dust. Although FDA banned triclosan from soap products in 2016, other personal care products still contain the chemical. These products include toothpaste, mouthwash, hand sanitizers, cosmetics, and antibacterial/antimicrobial clothing. However, EPA and FDA evaluate different use of triclosan, with EPA responsible for assessing the chemical in various consumer products, marketed as "microban." Therefore, individuals may encounter multiple sources of triclosan, especially on consumer products, such as toothbrush bristles, that tend to accumulate the chemical.

To improve and sustain gut microbiome health, the use of toxic pesticides is problematic. Although EPA denied a petition by Beyond Pesticides and Food and Water Watch to remove remaining triclosan uses in 2015, this study adds to growing evidence demonstrating the danger of this chemical. The data suggests that adequate public health protection requires EPA and FDA to work together to eliminate health risks from ongoing exposure to triclosan.

What to do: Beyond Pesticides holds that safer alternatives are available, and organic practices can protect public health and the environment. In addition to positive impacts on the human microbiome, organically grown food (i.e., milk, meat, strawberries, tomatoes, and a range of other foods) contain a much more diverse bacterial community than their conventional counterparts. Moreover, emphasis on converting to regenerative-organic systems and using least-toxic pest control to mitigate harmful exposure to pesticides, restore soil health, and reduce carbon emissions, should be the main focus. Learn more about soil and gut microbiota and its importance via Beyond Pesticide's journal article Sustaining Life: From soil microbiota to gut microbiome. For a complete history of the regulation of triclosan, see Beyond Pesticides' triclosan timeline and webpage on triclosan.

SOURCE: Zhang, J., Walker, M.E., Sanidad, K.Z. *et al.* Microbial enzymes induce colitis by reactivating triclosan in the mouse gastrointestinal tract. *Nat Commun* 13, 136 (2022). https://doi.org/10.1038/s41467-021-27762-y; Science Daily

GUT MICROBIOME | METABOLIC DISTRESS | MAY 12, 2022

Environmental Pesticide Exposure Alters Gut Microbes, Increasing Urgency for Organic Transition

A report published in *Environmental Health* finds that exposure to environmentally relevant concentrations of pesticides can alter gut microbial communities, as demonstrated through fecal samples. Over 300 environmental contaminants and their byproducts, including pesticides, are chemicals commonly present in human blood and urine samples. Ample evidence demonstrates that environmental contaminants, including pesticides, negatively affect the human mouth and gut microbes. However, fecal samples provide an accurate representation of the microbial community existing in the gut. These toxicants can alter hormone metabolism, which adversely affects health outcomes. Adverse health effects of environmental contaminants include reproductive and developmental defects, diabetes, cardiovascular disease, liver disease, obesity, thyroid disorders, and improper immune operation. Although studies show how chemical exposures affect human health, more research is now questioning how these toxic chemicals influence gut health. Therefore, studies like these highlight the importance of evaluating how chemical contaminants deregulate normal bodily function through microbiome changes. The report notes, "Our results highlight the need for future dietary intervention studies to understand effects of pesticide exposure on the gut microbiome and possible health consequences."

Researchers examined dietary exposure to 186 common pesticide residues

in the fecal excrement to determine impacts on the microbiome among 65 twins in the United Kingdom. Gut microbiota composition has associations with dietary habits, different life stages, geographical location, exercise, antibiotics, and disease states. However, researchers investigated if these associations can also impact concentrations of pesticide residues in excrement to indicate gut health alterations. Using metagenomics and metabolomics, researchers measured the metabolic activity of microbes in fecal matter and pesticides in urine excretion to note any bodily changes.

The report finds all urine samples contain pyrethroid or organophosphate insecticide residues, with 53 percent of urine samples containing glyphosate. Individuals who consume more fruits and vegetables grown with chemical-intensive practices have higher concentrations of organophosphate residues. Although urinary metabolite (pesticide breakdown product) excretion lacks a correlation with gut microbial changes, there are 34 associations between the concentration of pesticide residues and metabolite residues in fecal matter and gut health. Glyphosate excretion in the fecal matter correlates with an increase in bacterial species richness, fatty acid metabolites, and phosphate concentrations in the gut. For pyrethroids, deltamethrin metabolite, Br2CA, has a positive association with phytoestrogens enterodiol (dietary estrogen) and negative associations with specific amino acids in the gut.

The gut microbiome is a group of microorganisms, including bacteria, archaea, viruses, and fungi, that plays a crucial role in digestion, bodily function, detoxification, and immune and central nervous system regulation. Through the gut biome, pesticide exposure can enhance or exacerbate the adverse effects of additional environmental toxicants on the body. Since the gut microbiome shapes metabolism, it can mediate some toxic effects of environmental chemicals. However, with prolonged exposure to various environmental contaminants, critical chemical-induced changes may occur in the gut microbes, influencing adverse health outcomes. Like gut microbes, soil microbes are essential for the functionality of the soil ecosystem. Toxic chemicals damage the soil microbiota by decreasing and altering microbial biomass and soil microbiome composition (diversity). Pesticide use contaminates soil and results in a bacteria-dominant ecosystem causing "vacant ecological niches, so organisms that were rare become abundant and vice versa." The bacteria outcompete beneficial fungi, which improves soil productivity and increases carbon sequestration capacity. The resulting soil ecosystem is unhealthy and imbalanced, with a reduction in the natural cycling of nutrients and resilience. Thus, plants grown in such conditions are more vulnerable to parasites and pathogens. Moreover, the effects of climate change only exacerbate threats to soil health as studies show a link between global climate change and a high loss of microbial organisms in the soil ecosystem.

The findings add to the growing quantity of environmental studies linking pesticide exposure to metabolic distress and the respective health consequences. Although previous studies suggest pesticide exposure in the environment disrupts the gut microbiome, this report is the first to find an association between pesticide excretion and exposure to environmentally relevant concentrations of pesticides. Although most pesticide exposure decreases microbial species richness, some chemicals, like glyphosate, increase bacterial species richness.

However, an increase in species richness is not always positive as it cannot measure the function of how these bacteria work together. Studies find functional diversity declines faster with agricultural intensification then species richness. Functional diversity involves the interaction of species based on similarity in behavioral, morphological, physiological, or resource use as it relates more strongly to ecosystem function. Moreover, an increase in species richness in the gut microbiome can allow more resilient bacteria to flourish and outcompete other beneficial bacteria regardless of pathogenic potential. For instance, glyphosate kills bacterial species beneficial to humans and incorporated in probiotics, yet allows harmful bacteria to persist, leading to resistance. Similarly, glyphosate-exposed soils contain a greater abundance of genes associated with antibiotic resistance and a higher number of inter-species transferable genetic material.

Antibiotic resistance can trigger longer-lasting infections, higher medical expenses, the need for more expensive or hazardous medications, and the inability to treat life-threatening illnesses. Nevertheless, studies show an organic diet lowers individual exposure to pesticides, demonstrating a significant reduction in bodily pesticide concentration. Organic can also protect human gut microbe health by reducing the number of toxic chemicals within the body.

The report concludes, "We found that individuals who are regularly consuming organic products had higher healthy eating index values, but that other lifestyle choices are, in all likelihood, also contributing factors. We provide the first evidence of an association between pesticide excretion and changes in gut microbiome metabolism at environmental levels of exposure in the UK population. Our findings highlight the need for future dietary interventional studies to understand the impact of pesticide exposure on gut microbiome composition and function and its health implications."

What to do: To improve and sustain microbial communities, and thus human, animal, and environmental health, toxic pesticide use must stop. Beyond Pesticides challenges the registration of toxic chemicals due to their impacts on soil, air, water, and our health. Beyond Pesticides holds that safer alternatives are available, and organic practices can protect public health and the environment. In addition to positive impacts on the human microbiome, organically grown food (i.e., milk, meat, strawberries, tomatoes, and a range of other foods) contain a much more diverse bacterial community than their conventional counterparts.

SOURCES: Mesnage, R., Bowyer, R.C.E., El Balkhi, S. *et al.* Impacts of dietary exposure to pesticides on faecal microbiome metabolism in adult twins. *Environ Health* **21**, 46 (2022). https://doi.org/10.1186/s12940-022-00860-0.

PARKINSON'S DISEASE | MAY 26, 2022

Neurotoxic Pesticides Disrupt Gut Function Linked to Parkinson's Disease Development

A study published in *The International Journal of Biochemistry & Cell Biology* finds environmental exposure to neurotoxic pesticides increases Parkinson's Disease (PD) risk through gastrointestinal (GI) disruption. Research finds exposure to chemical toxicants, like pesticides, can cause neurotoxic effects or exacerbate preexisting chemical damage to the nervous system. Although the mechanism by which pesticides induce disease development remains unclear, this study suggests environmental pesticide exposure disrupts GI cells responsible for supporting the autonomic nervous system, enteric glial cells (EGCs). These cells are GI cells that play a critical role in the functional changes that accompany GI dysfunction, as this dysfunction is one of the earliest symptoms indicating the onset of PD.

Parkinson's disease is the second most common neurodegenerative disease, with at least one million Americans living with PD and about 50,000 new diagnoses each year. The disease affects 50% more men than women, and individuals with PD have a variety of symptoms, including loss of muscle control and trembling, anxiety and depression, constipation and urinary difficulties, dementia, and sleep disturbances. Identifying early biomarkers of PD, such as pesticide-mediated toxicity on GI cells, is crucially important as symptoms intensify over time, with no current cure for this fatal disease. While only 10 to 15 percent of PD incidents are genetic, PD is quickly becoming the fastest-growing brain disease due to nongenetic factors. Therefore, research like this highlights the need to examine alternate risk factors for disease development, especially if disease triggers are overwhelmingly nonhereditary. The study notes, "Overall, our study demonstrates that mitochondrial dysfunction in EGCs can induce autophagic dysregulation and a proinflammatory response, thereby affecting gut motility."

The researchers investigated how EGCs respond to environmental pesticide exposure using cellular and animal

models to understand the mechanisms driving gastrointestinal abnormalities. The pesticides implicated in the study include rotenone and tebufenpyrad. Both pesticides induce cell death via mitochondrial dysfunction among neurotransmitters that release, activate, or involve dopamine, also known as dopaminergic cell damage. Mitochondrial stress impairs molecular gradient function in EGCs, increasing inflammation of these cells consistent with GI cellular inflammation from neurotoxic pesticide exposure. Pesticide-induced mitochondrial dysfunction adversely affects smooth muscle motion and kinetic energy of the enteric nervous system (ENS) in the GI tract.

The gut, also known as the "second brain," share similar structural and chemical parallels to the brain. The microbiota in the gut plays a crucial role in lifelong digestion, immune and central nervous system regulation, as well as other bodily functions. Through the gut biome, pesticide exposure can enhance or exacerbate the adverse effects of additional environmental toxicants on the body. Since the gut microbiome shapes metabolism, it can mediate some toxic effects of environmental chemicals. However, with prolonged exposure to various environmental contaminants, critical chemical-induced changes may occur in the gut microbes, influencing adverse health outcomes. The impacts of pesticides on the human gut microbiome represent another pesticide assault on human health. Because the biome harbors between 10 and 100 trillion symbiotic microbes, pesticide exposure has effects on some of those bacteria. The human gastrointestinal tract and its digestive processes (aka, the "gut") mediate the function of several systems. Dysfunction of the gut microbiome is associated with a host of diseases, including cardiovascular disease, some cancers, multiple sclerosis, diabetes, asthma, Crohn's disease, Parkinson's disease, and inflammatory bowel disease, as well as allergies, autism, depression, obesity, and other disorders or syndromes.

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Parkinson's disease occurs when there is damage to the dopaminergic nerve cells (i.e., those activated by or sensitive to dopamine) in the brain responsible for dopamine production, one of the primary neurotransmitters mediating motor function. Although the cause of dopaminergic cell damage remains unknown, evidence suggests that pesticide exposure, especially chronic exposure, may be the culprit. Several studies identify various pesticides involved in the pathology of PD, including insecticides, rotenone and chlorpyrifos, and herbicides 2,4-D, glyphosate, and paraquat. The scientific literature comprehensively documents the neurotoxic properties of paraquat and rotenone as laboratory experiments reproduce features of Parkinson's in the brain of animals. A Washington State University study determined that residents living near areas treated with glyphosate—the most widely used herbicides in the U.S.—are one-third more likely to die prematurely from Parkinson's disease. In the Louisiana State University

study, exposure to 2,4-D, chlorpyrifos, and paraquat from pasture land, forestry, or woodland operations are prominent risk factors for PD, with the highest risk in areas where chemicals quickly percolate into drinking water sources. Overall, research finds exposure to pesticides increases the risk of developing PD from 33 percent to 80 percent, with some pesticides prompting a higher risk than others. Another study finds a 2.5-fold increase in PD risk among users of each chemical compared to non-users.

Occupational pesticide exposure poses a unique risk through direct handling and application. A 2017 study finds that occupational use of pesticides (i.e., fungicides, herbicides, or insecticides) increases PD risk by 110 to 211 percent. Even more concerning is that some personal protection equipment (PPE) may not adequately protect workers from chemical exposure during application. However, indirect nonoccupational exposure to pesticides can also increase the risk of PD. For instance, 90 percent of Americans have at least one pesticide compound in their body, primarily stemming from dietary exposure, like food and drinking water. These compounds have a global distribution, with evaporation and precipitation facilitating long-range atmospheric transport, deposition, and bioaccumulation of hazardous chemicals in the environment. Thus, exposure to these toxicants can cause several adverse environmental and biological health effects. With the increasing ubiquity of pesticides, current measures safeguarding against pesticide use must adequately detect and assess total chemical contaminants.

This study is the first to demonstrate that exposure to environmental neurotoxic pesticides impairs mitochondrial transformation of energy in living organisms, causing inflammation in EGCs. The mitochondrial dysfunction and inflammatory events induce gut dysfunction. Mitochondrial dysfunction is a significant aspect of PD pathology. Research demonstrates acute and chronic exposure to pesticides, like rotenone, organophosphates, and organochlorines, can inhibit the mitochondrial brain function responsible for cell regeneration and induce oxidative stress. Although many countries, including Europe and Canada, ban the use of chemicals like rotenone and organochlorines due to concerns about links to Parkinson's, among other illnesses, the U.S. merely restricts use as the U.S. Environmental Protection Agency (EPA) permits the use of rotenone to kill invasive fish species. Considering research demonstrates that a multitude of pesticides presenting a risk of developing PD belong to various pesticide classes and have a differing mode of action, advocates say that government officials must evaluate all health effects related to chemical exposure equally regardless of chemical composition. The study concludes, "Our findings have major implications in understanding the GI-related pathogenesis and progression of environmentally linked PD."

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This study adds to the large body of scientific studies strongly implicating pesticide's involvement in Parkinson's disease development. However, indirect health effects from pesticide exposure are not a new phenomenon as pesticide exposure can cause severe human health (i.e., endocrine disruption, cancer, reproductive/birth problems, neurotoxicity, loss of biodiversity, etc.) and wildlife and biodiversity issues, even at low residue levels. Although the exact cause of PD remains unknown, studies continuously identify exposure to pesticides and specific gene-pesticide interactions as significant adverse risk factors. Environmental triggers like occupational exposure to pesticides can prompt PD in individuals with or without the genetic precursor. PD can develop regardless of whether an individual is a carrier of the PD gene mutation. Pesticides themselves can possess the ability to disrupt neurological function. Therefore, the impacts of pesticides on the nervous system, including the brain, are hazardous, especially for chronically exposed individuals (e.g., farmworkers) or during critical windows of vulnerability and development (e.g., childhood, pregnancy). Considering that health officials expect Parkinson's disease diagnosis to double over the next 20 years, it is essential to mitigate preventable exposure to disease-inducing pesticides. For more information on the effects of pesticide exposure on neurological health, see Beyond Pesticides' Pesticide-Induced Diseases Database pages on Parkinson's disease, dementia-like diseases, such as Alzheimer's, and other impacts on cognitive function.

What to do: Parkinson's disease may have no cure, but prevention practices like organics can eliminate exposure to toxic PD-inducing pesticides. Organic agriculture represents a safer, healthier approach to crop production that does not necessitate toxic pesticide use. Beyond Pesticides encourages farmers to embrace regenerative, organic practices. Those impacted by pesticide drift can refer to Beyond Pesticides' What To Do in a Pesticide Emergency. Furthermore, see Beyond Pesticides' Parkinson's Disease article from the Spring 2008 issue of *Pesticides and You*.

Source: Bharathi N. Palanisamy, Souvarish Sarkar, Emir Malovic, Manikandan Samidurai, Adhithiya Charli, Gary Zenitsky, Huajun Jin, Vellareddy Anantharam, Arthi Kanthasamy, Anumantha G. Kanthasamy, Environmental neurotoxic pesticide exposure induces gut inflammation and enteric neuronal degeneration by impairing enteric glial mitochondrial function in pesticide models of Parkinson's disease: Potential relevance to gut-brain axis inflammation in Parkinson's disease pathogenesis, The International Journal of Biochemistry & Cell Biology, Volume 147, 2022, 106225, ISSN 1357-2725, https://doi.org/10.1016/j.biocel.2022.106225.

FARM EXPOSURE AND EFFECTS | FEBRUARY 10, 2022

Higher Disease Prevalence Among Farmers Highlights Need for Organic Practices and Compatible Materials

A National Institute of Environmental Health Sciences (NIEHS)-funded study finds that patterns of pesticide exposure among farmers have geographical and temporal significance. Specific use of and exposure to organophosphate and carbamate chemicals decrease enzyme activity within the body, resulting in greater health anomalies among farmers, especially during agricultural seasons. The use of xenobiotic (foreign chemical compounds) substances like pesticides and fertilizers in agriculture are increasing. Thus, those working with and around these toxicants must have protection. Considering that agricultural workers often experience pesticide exposure at higher rates due to occupation, long-term research must identify potential health concerns surrounding common pesticides. The study author, Dana Barr, Ph.D., states, "The majority of farmers in this study reported that they had at least one health symptom associated with pesticide intoxication. This investigation can be used to promote safer use of pesticides among farmers and mitigate exposure among residents living near a rice field. The findings will be critical for establishing and launching several preventive programs in the future."

Researchers evaluated the health effects of pesticide exposure among a cohort of farmers in Thailand during inactive and active rice farming periods. Using geographic information system (GIS) mapping, researchers compared acetyl- and butyryl-cholinesterase (AChE and BuChE) activities (a family of enzymes responsible for neurotransmission) among farmers across regions within the Ratchasima Province of Thailand. Scientists also collected data on the location of rice paddy fields. The results demonstrate that farmers exhibit higher adverse health symptoms from pesticide exposure during active farming periods. The main pesticides of concern are organophosphates and carbamates, due to the effects on enzyme function, as both AChE and BuChE activity decrease during active farming. Moreover, GIS mapping data shows enzyme inhibition within and adjacent to farms, indicating spatial and temporal changes in health.

The agricultural industry has a long-standing history of synthetic chemical use, which disproportionally affects farmworkers' health. Farmworkers and persons exposed to high levels of pesticides have an increased risk of developing brain tumors and over 45 different cancers.

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use, which disproportionally affects farmworkers' health. The journal *Occupational and Environmental Medicine* indicates that farmworkers and persons exposed to high levels of pesticides have an increased risk of developing brain tumors and over 45 different cancers. Farmworkers are at the highest risk of pesticide-induced diseases, and their average life expectancy bears this out. According to the National Farm Worker Ministry, farmworkers have an average life span of 49 years, a 29 year difference from the general U.S. population. Moreover, a recent study finds increased COPD for other pesticide-intensive occupations like landscapers (e.g., gardeners/landscapers). Although pesticide exposure through the skin or inhalation is most prevalent among individuals working around these toxic chemicals, pesticide exposure is ubiquitous and not only confined to a field. The general population can encounter toxic chemicals through residues in food and water or through chemical drift.

Over 300 environmental contaminants and their byproducts—from chemicals in plastics to cosmetic/personal care products—are commonly found in water bodies, food commodities, and human blood/urine samples. These toxicants can alter hormone metabolism, producing endocrine-disrupting effects that put the health of animals, humans, and the environment at risk. Synthetic chemicals in pesticides can accumulate in bodies, causing an amalgamation of health effects. These effects can range from heightened risks of various cancers (i.e., prostate, hepatic, liver, etc.) and endocrine disruption to mental health problems (i.e., depression), respiratory illnesses (asthma), and many other pesticide-induced diseases. Therefore, understanding how pesticide exposure influences disease risk is essential in protecting the future of human, animal, and ecological health.

This study adds to the growing body of research demonstrating occupational exposure to pesticides contributes to higher disease prevalence among individuals working with and around these toxic compounds. Like this study, other research demonstrates that exposure to organophosphate insecticides, like chlorpyrifos, has endocrine disruption properties that induce neurotoxicity via acetylcholinesterase (AChE) inhibition in the nervous tissue. Inhibition of AChE can cause a buildup of acetylcholine (a chemical neurotransmitter responsible for brain and muscle function). This chemical buildup can lead to acute impacts, such as uncontrolled, rapid twitching muscles, paralyzed breathing, convulsions, and, in extreme cases, death. However, the inhibition of AChE is non-specific, making the dispersal of pesticides with this biological activity a severe threat to wildlife and public health.

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Although resistance to banning pesticides is tied to crop yields, studies as recent as 2022 show a ban on even the most extensively used pesticides have no adverse impacts on yield. Although this study takes place in Thailand, the results apply to chemical-intensive farmers across the globe. Adverse health effects related to pesticide exposure can occur regardless of geographical location and agricultural practices. For instance, cancer incidents are consistent among women and men agricultural workers, regardless of location, suggesting an underlying common risk factor (i.e., pesticides). Although farmers in the study use personal protective equipment (PPE), the equipment does not always protect against dermal exposure and inhalation after application (i.e., residues on clothing, shoes, hair, etc.). Moreover, current legislation fails to encompass the full impacts of pesticides on farmworkers, especially underrepresented individuals who disproportionately experience more severe health issues.

The study concludes, "[F]armers should be made aware of the safety practices of pesticide handling and application and the proper use of PPE through effective education and training programs. Importantly, the government should consider changing the current policy to allow effective restrictions of pesticide importation, production, and application. In addition, GIS can assist the assessment of agricultural pesticide exposure in the general population and can enable the location verification and pattern visualization of the OP and carbamate poisoning cases. Our work can be used to assist the establishment of a pesticide application free zone to minimize pesticide exposures in the residential areas."

What to do: One way to reduce human and environmental contamination from pesticides is to buy, grow, and support organic. See Beyond Pesticides' webpage, Health Benefits of Organic Agriculture. Learn more about farmworker protection by visiting Beyond Pesticides' Agricultural Justice page.

SOURCE: Sombatsawat E, Barr DB, Panuwet P, Robson MG, Siriwong W. Pesticide toxicity assessment and geographic information system (GIS) application in small-scale rice farming operations, Thailand. Sci Rep. 2022 Jan 11;12(1):499. doi: 10.1038/s41598-021-04523-x.

MULTIGENERATIONAL EFFECTS AND CANCER | MARCH 10, 2022

EPA Overlooks Glyphosate and Roundup Ingredients' Cancer, DNA Damage, and Multigenerational Effects

Glyphosate and glyphosate-based herbicides (GBH) like Roundup® induce DNA damage and alter biological mechanisms (gene regulatory microRNAs [miRNAs or miRs]) associated with cancer development. According to the study published in *Toxicological Sciences*, DNA damage mainly occurs through oxidative stress from GBH exposure. Moreover, DNA damage and other biological mechanisms that cause carcinogenicity (cancer) occur at doses assumed "safe" by pesticide regulators such as the U.S. Environmental Protection Agency (EPA).

Glyphosate is the most commonly used active ingredient worldwide, appearing in many herbicide formulas, not just Bayer's (formerly Monsanto) Roundup®. The use of this chemical has been increasing since the inception of crops genetically modified to tolerate glyphosate over two decades ago. The toxic herbicide readily contaminates the ecosystem with residues pervasive in food and water commodities. In addition to this study, literature proves time and time again that glyphosate has an association with cancer development, as well as human, biotic, and ecosystem harm.

Study lead author Michael Antoniou, Ph.D., cautions, "Our results are the first to simultaneously show glyphosate and Roundup toxicity in a whole mammalian animal model system and provide a mechanism—oxidative stress—by which DNA damage has been observed in other systems, such as mammalian tissue culture cells. These findings show that glyphosate and Roundup score positive in various tests of carcinogenicity—transcriptome/epigenome/miRNA changes, oxidative stress, protein misfolding, and DNA damage—in a living animal (rat) that is accepted as a surrogate for human health effects. In my view, this strengthens the argument that exposure to Roundup herbicides can lead to the type of cancer suffered by the plaintiffs in many of the court cases—non-Hodgkin lymphoma."

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This study represents a follow-up that builds on the finding of a previous one by the same authors. The previous study compared the effects of MON 5227 (an active ingredient in Roundup) and glyphosate alone in rats and found

both ingredients to cause gut microbiome disruption and oxidative stress related to possible liver damage. Thus, the present study intends to determine damage in the liver by analyzing tissue samples. Following standard regulatory testing for pesticide approval, researchers investigated biochemical changes in the blood of the kidneys and liver after exposure to glyphosate and four active ingredients in Roundup formulas: MON 52276 (European Union), MON 76473 (United Kingdom), and MON 76207 (United States). Additionally, researchers performed tests not carried out by standard testing, including observation on molecular changes in the biological function of gene expression and epigenetics (e.g., DNA methylation that changes the activity but not the sequence of a DNA segment) in the kidneys and liver. To highlight changes in biological function linked to cancer, researchers used genetically engineered (GE) cell lines and tested them for direct DNA damage.

The results confirm that liver damage occurs from exposure to glyphosate and Roundup, leading to alterations of gene expression and miRNA (small RNA) in the liver. Specifically, glyphosate and MON 52276 alter nine gene expressions in the liver and kidneys responsible for oxidative stress and DNA damage, prompting cancer development. Researchers suggest changes in miRNA can disrupt the regular function of cell growth regulator genes, like p53, resulting in cancer. The changes in gene expression of p53 strongly indicate a possible pathway for DNA damage and thus a major cancer development risk factor. Furthermore, various research, including this one, demonstrates increases in small RNA, like miR-10 from GBH exposure, have an association with blood cancer development, particularly leukemia and non-Hodgkin lymphoma. Dr. Antoniou notes, "The new data showing changes in miRNA patterns add yet more evidence to the cancer-causing potential of glyphosate and Roundup. What is more, our results show that it is not just Roundup, which is a mixture of glyphosate with various additives, that has carcinogenic potential, but also glyphosate alone."

EPA's not carcinogenic classification of glyphosate perpetuates environmental injustice among individuals disproportionately exposed to chemicals like farmworkers, especially in marginalized communities. Chemical companies knowingly failed and continue to fail to warn farmers adequately about the dangers of the pesticide, and EPA has failed to warn the public that the manufacturer's (Bayer/Monsanto) and agency's chemical review conclusions have been widely disputed.

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The territory for research on pesticides' potential carcinogenicity, and other impacts on human health, is ridiculously complicated. Yet, there is some convergence across research that exposure to certain pesticides increases the risk of developing some cancers. The association that has been in the blinding spotlight for the past few years is between exposures to glyphosate and glyphosate-based herbicides and the risk of developing cancer, particularly non-Hodgkin Lymphoma (NHL). Beyond Pesticides has covered the mounting evidence of the dangers of glyphosate, including a meta-study that suggests a compelling link between exposures to glyphosate-based herbicides and increased risk of NHL. In addition, it has written extensively on developments in the science and regulatory arena, including:

- the International Agency for Research on Cancer (IARC) 2015 landmark designation of glyphosate as potentially carcinogenic
- evidence that the Environmental Protection Agency colluded with Monsanto (maker of Roundup, the most widely used glyphosate-based herbicide) to advantage industry and that Monsanto had ghostwritten research that countered scientific conclusions on the cancer associations of the compound
- and California's 2017 listing of glyphosate under Proposition 65 as a probable carcinogen and a 2018 Appellate Court affirmation of its ability to do so.

Glyphosate has been the subject of a great deal of public advocacy and regulatory attention, as well as the target of thousands of lawsuits. Beyond Pesticides has covered the glyphosate tragedy extensively; see its litigation archives for multiple articles on glyphosate lawsuits. In June 2020, facing approximately 125,000 suits for Roundup's role in cancer outcomes, Bayer announced a $10 billion settlement to resolve roughly 75% of current and potential future litigation. However, roughly 30,000 complainants ultimately did not sign on to the settlement, so the queue of potential lawsuits is still potentially enormous. Although Bayer tried for a second settlement (~$2 billion) to handle future claims, a U.S. District Court judge for the Northern District of California rejected Bayer's 2021 settlement proposal. The judge stated that the settlement was inadequate for future victims diagnosed with cancer after using the herbicide. Bayer has never acknowledged any harm caused by glyphosate, maintaining the chemical is safe for use. However, in July 2021, Bayer announced its plan to end sales of its glyphosate-based herbicides (including its flagship product, Roundup) in the domestic U.S. residential lawn and garden market in 2023.

For the first time, this study demonstrates epigenetic changes in DNA, proteins, and small RNA profiles in the liver of organisms exposed to glyphosate and Roundup formula MON 52276.

Researchers observed activation of DNA repair mechanisms in response to DNA damage from glyphosate. Moreover, oxidative stress and the unfolding of proteins occurred at lower concentrations of Roundup, in which the same concentration of glyphosate produced no effect. The researchers recommend regulators rely on methods to detect metabolic changes that conventional biochemical and tissue analyses overlook. Glyphosate acts on the shikimate pathway, present in plants, fungi, bacteria, archaea, and protozoa. Thus, many taxonomic groups of microorganisms are sensitive to glyphosate. Moreover, chronic exposures to the herbicide could lead to the dominance of resistant strains in bacterial communities. Some glyphosate-vulnerable bacterial strains can become resistant to glyphosate (glyphosate-tolerant class II EPSPS). For instance, glyphosate-resistant bacterial strains like *E. coli* and *Pseudomonas* alter gene function to enhance the outflow of glyphosate from the bacterial cell. Thus, this resistance mechanism encourages cross-resistance against antibiotics for pathogenic bacterial species like *E. coli* and *Salmonella*, altering the microbiome.

Overall, the researchers determined oxidative stress, an imbalance between reactive oxygen species (ROS) and biological mechanisms to detoxify ROS, likely causes liver damage. This liver damage, in turn, leads to inflammation that can damage DNA and prompt carcinogenicity. Similar to this study, others suggest that glyphosate may impact other metabolic pathways beyond the known shikimate. A report by the University of Turku, Finland states, "Even in glyphosate-resistant species, the interference of the herbicide on mitochondrial metabolism may induce oxidative stress and lead to toxic effects."

Although Bayer announced the end of glyphosate sales in 2023, sales of Roundup may continue with different active ingredients. It is essential to note that the study also demonstrates ingredients in Roundup are even more toxic than glyphosate itself. Therefore, new formulations without glyphosate do little to mitigate the problem, especially regarding synergistic (combined) impacts of so-called "inert" ingredients in glyphosate formulations.

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Considering pesticide exposure does not affect just one part of the body, but multiple organs, more studies need to assess what other organs or biological mechanisms glyphosate targets, triggering cancer development. These results could strengthen the legal cases of cancer patients in the U.S. who are suing Bayer/Monsanto because they have evidence that their exposure to Roundup caused their disease. The authors conclude, "[A]doption by regulatory agencies of multiomics analyses would result in more accurate evaluation of a chemical's toxicity and therefore better protection measures being enacted with major public health benefits."

Cancer is one of the leading causes of death worldwide, with over eight million people succumbing to the disease every year. Notably, IARC predicts an increase in new cancer cases from 19.3 million to 30.2 million per year by 2040. Therefore, studies related to pesticides and cancer will aid in understanding the underlying mechanisms that cause the disease. Beyond Pesticides challenges the registration of chemicals like glyphosate in court due to their impacts on soil, air, water, and our health. While legal battles press on, government officials must eliminate the use of toxic synthetic herbicides to avoid the adverse effects of chemical exposure and contamination.

What to do: Emphasis on converting to regenerative-organic systems and using least-toxic pest control to mitigate harmful exposure to pesticides, restore soil health, and reduce carbon emissions, should be the main focus moving forward. Public policy must advance a shift to organic rather than allow unnecessary reliance on pesticides. Considering glyphosate levels in the human body decrease by 70% through a one-week switch to an organic diet, purchasing organic food whenever possible—which never allows glyphosate use—can help curb exposure and resulting adverse health effects. For more information on the adverse effects of pesticides on human health, see Pesticide-Induced Diseases Database (PIDD) pages on cancer (including lymphoma) and other diseases. Moreover, Beyond Pesticides provides tools, information, and support to take local action: check out our fact-sheet on glyphosate/Roundup and our report, Monsanto's Roundup (Glyphosate) Exposed. Contact us for help with local efforts and stay informed of developments through our Daily News Blog and our journal, *Pesticides and You*. Additionally, check out Carey Gillam's talk on Monsanto's corruption on glyphosate/Roundup at Beyond Pesticides' 36th National Pesticide Forum.

SOURCE: Robin Mesnage, Mariam Ibragim, Daniele Mandrioli, Laura Falcioni, Eva Tibaldi, Fiorella Belpoggi, Inger Brandsma, Emma Bourne, Emanuel Savage, Charles A Mein, Michael N Antoniou, Comparative Toxicogenomics of Glyphosate and Roundup Herbicides by Mammalian Stem Cell-Based Genotoxicity Assays and Molecular Profiling in Sprague-Dawley Rats, *Toxicological Sciences*, Volume 186, Issue 1, March 2022, Pages 83–101, https://doi.org/10.1093/toxsci/kfab143 GM Watch

ENVIRONMENTAL INJUSTICE: DISPROPORTIONATE EXPOSURE AND IMPACTS | APRIL 22, 2022

Black, Indigenous, and People of Color Community at Disproportionate Risk from Pesticides, Study Finds

A study published on April 18 finds that people in U.S. BIPOC (Black, Indigenous and People of Color) communities, as well as those living in low-income communities, endure a very disproportionate rate of exposure to pesticides, and of subsequent risks of harm. It finds that such disparities exist in both urban and rural communities, and at all points in the pesticide "life cycle," from manufacture to application. A section of Beyond Pesticides' *Retrospective 2021* issue of *Pesticides and You*, "Retrospective 2021: A Call to Urgent Action," is devoted to such inequities. Section IV, "Disproportionate Pesticide Harm Is Racial Injustice: Documenting Victimization: Structural Racism," reprises Beyond Pesticides' 2021 coverage of environmental injustices. It also calls for urgent action re: federal and state "evaluations that go into toxic chemical regulation . . . to reform and replace the current regulatory decision-making process, which is empirically racist, with one that acknowledges and cares for those with the highest real-world vulnerabilities and exposure[s]."

The first comprehensive assessment of disparities in pesticide protections and oversight in the U.S., the study paper appeared in the journal *BMC Public Health*. The authors set out the broad history of how humanity moved from "Traditional Ecological Knowledge" approaches to pests, practiced by indigenous populations the world over—through use of "the largest and most effective pest controller," nature itself—to the current era of massive deployment of chemical pesticides. They also provide the overlay of the dynamic intersection of institutional racism and class discrimination in the U.S. with the current, chemically intensive, paradigm. "This structural racism and classism, defined here as a system brought about by historical, institutional, cultural, or behavioral societal actions that routinely disadvantage, harm, and cumulatively oppress BIPOC and/or people of low-income or wealth, has led to significant disparities in exposure to many pollutants that can lead to premature death or chronic disease."

The acute and chronic health impacts of pesticide exposure are myriad. Beyond Pesticides identifies specific diseases and other health anomalies linked to exposures to pesticides, and points readers to research papers that provide evidence of such links, in its Pesticide-Induced Diseases Database. Through its Gateway on Pesticide Hazards and Safe Pest Management, the public can find details on roughly 400 pesticides, including fact sheets, uses, health and environmental effects, and alternatives.

The disproportionate exposures and impacts of pesticide use for BIPOC and low-income community members tend

to occur through occupational activities, largely in agriculture, and/or via places of residence, which may be near to agricultural storage and application sites or pesticide manufactories, or in substandard, overcrowded, and usually urban housing that is typically subject to the use of pesticides as a short-term fix for chronic pest problems. Of course, these inequities are layered over the typical exposure routes to which nearly everyone in the U.S. is vulnerable: through food, contaminated drinking water and air, and/or pesticides used on public and private landscapes and in all kinds of buildings.

The peer-reviewed study was conducted by researchers from environmental/conservation, farmworker, and racial justice organizations, as well as from HBCUs (Historically Black Colleges and Universities). The researchers' objective was "to identify and discuss not only the historical injustices that have led to these disparities, but also the current laws, policies and regulatory practices that perpetuate them to this day with the ultimate goal of proposing achievable solutions." The team asserts that the disparities identified continue via current regulations and statutes that (1) inadequately protect workers, (2) operate with a pesticide safety "double standard," and (3) permit the export of toxic pesticides to "developing" countries, as detailed in these specific findings:

- disproportionate exposures to harmful pesticides: biomarkers for 12 dangerous pesticides, tracked over the past 20 years, were found in the blood and urine of Mexican-American and Black people at average levels up to five times those in white people.
- weaker protections for agricultural workers: although 10,000–20,000 largely Latinx—farmworkers are sickened annually from pesticide exposure, such workers are not covered by the same regulatory pesticide protections provided to the general public.
- unequal risks: people of color comprise 38% of the aggregate population of California, Georgia, Arkansas, Tennessee, Missouri, South Carolina, and Louisiana, but that 38% represents 63% of those living nearby to 31 pesticide manufacturing facilities that are in violation of environmental laws (such as the *Clean Air Act* and the *Clean Water Act*).
- poor enforcement: based on available data for a recent five-year period, approximately 1% of agricultural operations that use pesticides had any annual inspections for violations of worker protections—despite violations found at nearly half of inspected facilities; further, enforcement actions proceeded against only 19% of the violators.
- toxic housing: 80% of low-income housing sites in New York State, for example, regularly apply pesticides indoors; a home air quality monitoring study found that 30% of pregnant African American and Dominican women in New York City had at least eight pesticides in their bodies, and 83% had at least one pesticide in umbilical cord samples.
- export of harm: pesticides banned in the U.S. are nevertheless allowed to be produced here and exported; the study notes that organophosphate and carbamate pesticides banned domestically were sold to 42 countries between 2015 and 2019, and 78% of importing countries report more than 30% of their workforce members are poisoned by pesticides annually.

On the matter of the weaker protections for farmworkers and others exposed occupationally to pesticides, the authors explain: "For the general population, exposed mainly to pesticides through their diet, water and residential use, EPA takes a risk-only approach—approving a pesticide only if the agency determines that it will not result in significant harm. Yet for farmworkers and those exposed to pesticides mainly through their work, EPA takes a cost-benefit approach whereby harm to workers is allowed as long as the purported benefit of the pesticide, presumably to the grower, sufficiently offsets those harms." Such unequal treatment is dangerous, unethical, and functionally racist.

In addition, the paper asserts that racial, ethnic, and income disparities persist in part because of policies and regulatory practices that fail to:

- implement Executive Orders (EOs) on EJ (environmental justice) matters, such as the U.S. Environmental Protection Agency's (EPA's) failure to implement EO 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-income Populations"—in the 25 years since its 1994 issue.
- account for off-label pesticide use and provide the training and support that could reduce such uses; examples of the problems include these, from the research: 14–65% of surveyed farmworkers across multiple states reported receiving no pesticide safety instruction by their employer; and although EPA touts the refrain, "the label is the law," it nevertheless does not require that pesticide manufacturers provide pesticide labels in any language other than English—despite the facts that 83% of U.S. farmworkers are Latinx or Hispanic, and only 28% of farmworkers report that they can read English well.
- monitor and follow-up effectively with vulnerable communities once a pesticide has been approved; new pesticide products are often approved with minimal toxicity assessments, making an effective monitoring system (for health and environmental impacts) critical; but periodic review of registered pesticides is compromised by a lack of both epidemiological data and follow-up data on people with the greatest exposures; the paper asserts, "An underfunded surveillance system that relies exclusively on a dataset that extensively underrepresents harm to BIPOC and lower-income com-munities is designed to fail."
- implement important protections for children, who are uniquely vulnerable to developmental toxicants; the 1996 *Food Quality Protection Act* (FQPA)

required an extra margin of safety for children—a "safety factor" that would reduce the amount of pesticide considered "safe" for children by tenfold; but the researchers note that "implementation of the . . . safety factor has been dismal from the outset. . . . A recent in-depth analysis of 47 non-organophosphate pesticides found that only 13% of acute food exposures and 12% of chronic food exposures incorporated any FQPA children's safety factor whatsoever."

The research paper states the "meta" issue clearly: "This is not simply a pesticides issue, but a broader public health and civil rights issue. The true fix is to shift the [U.S.] to a more just system based on the Precautionary Principle to prevent harmful pollution exposure to everyone, regardless of skin tone or income. However, there are actions that can be taken within our existing framework in the short term to make our unjust regulatory system work better for everyone."

The solutions proposed by the researchers include regulatory actions that could reduce the disparate impacts of pesticides on BIPOC communities by:

- eliminating (or reducing the magnitude of) the pesticide safety double standard
- implementing a system to adequately monitor and account for harms to environmental justice communities
- strengthening worker protections
- reducing unintended pesticide harms
- adequately protecting children, who are the most vulnerable to pesticide harms
- prohibiting export of unregistered pesticides to other countries
- assessing and rectifying regulatory capture within the EPA Office of Pesticide Programs

Beyond Pesticides has long pointed to the Precautionary Principle as an optimal approach to the registration and use of all pesticides. In 2019, for example, we argued for precaution as a fundamental and important platform for pesticide reform, given the regulatory inefficacy and negligence of EPA. We have also called attention to the "regulatory capture" of federal agencies, including the USDA's (U.S. Department of Agriculture's) National Organic Standards Board, and EPA—particularly, the Office of Pesticide Programs, as detailed here, here, and here.

The study makes abundantly clear the importance of the work of environmental justice, and other health and environmental, organizations, which have welcomed the publication of this research. Jeannie Economos of the Farmworker Association of Florida commented, "The people doing some of the most important work in our country—harvesting the food that feeds the nation — bear a disproportionate burden of the toxic pesticide exposure that risks their and their family's health and lives. This report makes this unequivocally clear, so we ask our political leaders committed to environmental justice, 'What are you going to do about it?'"

"Pesticides are more likely to harm people of color because of firmly entrenched policies and laws that stack the deck against them. This research identifies concrete steps the Biden administration can take to begin righting these wrongs." Beyond Pesticides will continue to monitor progress on inequities related to pesticides, agriculture, farmworker well-being, and health of BIPOC communities in the U.S.

Amy K. Liebman of the Migrant Clinicians Network added, "Our regulatory systems exclude farmworkers from basic protections. This results in farmworkers and their families being regularly overexposed to pesticides that have acute and chronic health repercussions, and negatively affect the health of agricultural communities. Strong and enforced regulations are needed now." Another response came from Fatemeh Shafiei, director of environmental studies and associate professor of political science at Spelman College: "For too long communities of color have served as literal dumping grounds for many of our nation's most dangerous toxic chemicals, including pesticides. This must change. It's time for state and federal regulators across the U.S. to jumpstart aggressive efforts to put an end to this deeply troubling form of environmental racism."

Finally, Nathan Donley, PhD, lead author on the research and environmental health science director for the Center for Biological Diversity, commented, "Pesticides are more likely to harm people of color because of firmly entrenched policies and laws that stack the deck against them. This research identifies concrete steps the Biden administration can take to begin righting these wrongs." Beyond Pesticides will continue to monitor progress on inequities related to pesticides, agriculture, farmworker well-being, and health of BIPOC communities in the U.S.

What to do: For current reporting on matters related to environmental justice, see Beyond Pesticides' Daily News Blog EJ archives. We also recommend that readers check out Section IV, "Disproportionate Pesticide Harm Is Racial Injustice: Documenting Victimization: Structural Racism" in our Retrospective 2021: A Call to Urgent Action" issue of *Pesticides and You*.

SOURCES: Donley, N., Bullard, R.D., Economos, J. *et al.* Pesticides and environmental injustice in the USA: root causes, current regulatory reinforcement and a path forward. *BMC Public Health* 22, 708 (2022). https://doi.org/10.1186/s12889-022-13057-4.

POST-HURRICANE WATER CONTAMINATION | JULY 20, 2022

Post-Hurricane Flood Cleanup in Houston Exposed Residents to Range of Pesticides and Industrial Chemicals

Flood cleanup in Houston after Hurricane Harvey increased resident exposure to a range of pesticides and other industrial chemical compounds, according to a study published recently in the International Journal of Environmental Research and Public Health by scientists at Oregon State University (OSU). The findings are particularly concerning for a community already subject to some of the highest rates of environmental contamination in the country. "Houston is one of our most industrialized cities," said study coauthor Kim Anderson, PhD, of OSU. "When we look a year after the storm, we see that several neighborhoods that are closer to industrial zones—socioeconomically disadvantaged neighborhoods—had higher concentrations of chemicals right from the get-go, and that was only exacerbated when the hurricane came in."

Hurricane Harvey made landfall in Southern Texas as a category 4 hurricane in 2017. Widespread flooding resulted in damage to chemical plants and oil refineries throughout the city, including 13 of the astounding 41 Superfund sites present in the city of Houston. Cleanup and remediation efforts brought concern among residents that chemicals from these industrial sites were being mixed with floodwaters, exposing individuals to a range of hazardous compounds.

To better understand what chemicals individuals were exposed to and their level of exposure, scientists utilized silicone wristbands originally developed by Dr. Anderson. The wristbands passively sample chemicals the wearer is exposed to in the environment. Scientists were able to get approval for their study within a week, and subsequently began distributing silicone wristbands within three weeks, timing their use as cleanup efforts were still underway. "At that point, flooding was still occurring. I think that's a huge strength of this study," said coauthor Diana Rohlman, PhD, associate professor at OSU. "From the public health perspective, that's the data people want: 'I'm actively flooded, actively cleaning my house; what am I being exposed to right now?'"

Research participants wore the silicone wristbands for seven days. Researchers then took the wristbands back to the lab, where over 1,500 potential chemicals, including pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), personal care products, flame retardants, phthalates, pharmaceuticals, and other industrial compounds were screened.

To compare the results recorded post-hurricane clean up to a baseline level of exposure for Houston residents, researchers followed up with a certain subset of study participants one year later. Overall, 172 individuals participated in the initial testing, and 238 in the follow-up testing. Within those groups, 99 Houston residents participated in

both the initial screening and the follow-up.

Post hurricane cleanup resulted in Houston residents being exposed to 162 different chemicals. Of these, 41 were pesticides, 25 PAHs, 14 flame retardants, 36 personal care products, 10 phthalates, four PCBs, two phar maceuticals, and 30 other industrial compounds. During the next year's follow-up, researchers still found Houston residents exposed to 137 different chemicals. Within these two groups 101 chemical compounds overlapped. However, most concerning is that for 75% of the compounds detected at both times, including personal care products, pesticides, flame retardants, pharmaceuticals, and industrial compounds, levels of these chemicals were significantly higher during flood clean up.

Scientists note that it is difficult to specify health risks based on the sampling, as many of the chemicals detected do not have health guidelines or as much toxicological research behind them. As a result, they recommend in an OSU press release that those cleaning up after floods wear personal protective equipment when working in questionable standing waters.

The pesticides detected, including the insecticide chlorpyrifos, mosquito larvicide methoprene, synergist piperonyl butoxide and a range of synthetic pyrethroids, all present hazards to human health. Yet, beyond individual chemical toxicity, there is concern regarding the potential synergistic effect of multiple simultaneous chemicals.

While the range of contaminants detected after Hurricane Harvey is particularly concerning within highly industrialized Houston, it is possible that similar levels of contamination would be seen in every highly industrialized urban city area subject to flooding. A 2019 study looking at urban runoff from heavy rains in 17 states found most samples containing over 73 different chemicals per site, with pesticides accounting for the most frequently detected chemicals.

While hurricanes are often associated with widespread damage to buildings and other infrastructure, the public health toll from this exposure will continue as climate change increases the size and intensity of hurricanes hitting the U.S.

What to do: For more information on the risk pesticides pose to waterways and action, see Beyond Pesticides Threatened Waters program page.

SOURCE: Samon, S.M.; Rohlman, D.; Tidwell, L.G.; Hoffman, P.D.; Oluyomi, A.O.; Anderson, K.A. Associating Increased Chemical Exposure to Hurricane Harvey in a Longitudinal Panel Using Silicone Wristbands. *Int. J. Environ. Res. Public Health* 2022, *19*, 6670. https://doi.org/10.3390/ijerph19116670; Oregon State University press release

GLOBAL PESTICIDE HAZARD FOOTPRINT | DECEMBER 7, 2022

Developed Countries with 18% of World Population Responsible for 49% of Pesticide Hazard Footprint

A recent study from Australian researchers has investigated pesticide use through an unusual lens—by quantifying the environmental footprints of pesticide use in 82 countries and territories (and eight regions), and then concluding that international trade drives significant pesticide use. The researchers identify the U.S., Brazil, and Spain as the biggest exporters of the "pesticide hazard load" associated with those environmental footprints, and China, the United Kingdom, and Germany as the top three importers. They lay responsibility for this hazard load at the feet of the unsustainable intensification of chemical-intensive agriculture (via synthetic pesticide and fertilizer use during the past 50 years) and ratcheting consumer demand for goods and services. Indeed, they conclude that the latter, in "developed" countries, is responsible for a substantial portion of the pesticide pollution in *other* countries.

The study authors note that previous "efforts to quantify the environmental footprints of global production and consumption have covered a wide range of indicators, including greenhouse gas emissions, water scarcity, biodiversity, nitrogen pollution, acidification, land use, and others, but they have largely missed . . . represent[ing] the environmental pressures exerted by pesticide use." The researchers set themselves the task of quantifying the "footprints" of pesticide use, from producers to final consumers, in order to map how international trade drives pesticide use, and identify potential repercussions if/when a nation's policy were to shift from domestic production toward increased importation. They note that prior research has evidenced impacts of specific products and processes, but has not accounted for the role of globalization and international trade.

The researchers remind readers that the intensity of chemical-dependent agriculture (which uses copious amounts of synthetic pesticides and fertilizers) is unsustainable; these practices degrade both terrestrial and aquatic ecosystems, deplete water resources, and contribute to the climate crisis, among other impacts. Beyond Pesticides has spent its tenure demonstrating that pesticide use has huge impacts on the functions of ecosystems, biodiversity (and insect and

pollinator loss, especially), natural resources, and human health.

The study employs an unusual metric in its investigation; it defines pesticide footprints as the "hazard load" of pesticides used for crop production to satisfy consumer demand for food (for humans and animals), textiles, and services that utilize either. They define hazard load (HL) as the measurement of the total body weight of nontarget organisms that would be required to absorb pesticides accumulating in the environment. The higher the HL, the greater the environmental pressure related to consumption. (The study analyzes only the use of insecticides, herbicides, and fungicides on croplands, did not account for pesticide impacts on human health or for acute exposure impacts, and used data from 2015.)

The researchers' analyses account for roughly 79% of global pesticide use, and 70%, 70%, and 63%, respectively, of use in Brazil, the U.S., and China, the world's top three pesticide consumers. Insecticides, according to the researchers, contribute 80% of the global insecticide footprint, and herbicides, 10%. The study's methodology included estimating residual pesticides—the amounts remaining in the environment after application. Of the 3.24 tonnes (or 3.57 U.S. tons) of pesticides analyzed, the study finds that roughly 9.3% accumulated as residues in the environment.

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That amount of residue translates to a hazard load of about two gigatonnes (2,204,622,622 U.S. tons) of organismic body weight (see last paragraph), 34% of which the team attributes to consumption by developed countries (which house 18% of global population), and 66% to consumption in developing countries, which represent most of the world's people. Try, for a moment, to imagine how many organisms that HL would require; it is a stupefying quantity that would be required to absorb the environmental residue from that 79% of global pesticide deployment.

The world's pesticide footprint is distributed across sectors, with plant-based foods comprising the largest portion at 59%; the orchard fruit and grapes sector accounts for a whopping 17% of the global figure. Animal-based foods contribute roughly 11%. Strikingly, the study finds that "17% of the pesticide footprints in developed countries is attributed to the consumption of empty calorie food products such as soft drinks, alcoholic drinks, chocolates, ice-creams, and sugars. In contrast, these food items contribute only 9%

of the footprints in developing countries." Clothing and other textile sectors comprise 4% of the global pesticide footprint; consumption of food and textile products in the service and industrial sectors are responsible for another 13%.

The well-known outsized environmental footprint of the developed economies/countries in other regards (climate, water consumption, energy use, et al.) is borne out in the pesticide footprints, as well. The study authors assert that approximately "49% of pesticide footprints caused by the consumption in developed countries [—which harbor only 18% of global population—is] embodied in international trade (i.e., the pesticide hazard loads were occurring abroad), while the consumption of imported goods contributes only 23% of the pesticide footprints in developing countries."

Roughly 32% of global pesticide footprints are traded internationally (i.e., 32% of global pesticide hazard loads occurred outside of the country of final consumption). More than 90% of pesticide footprints imported by some European countries were caused by active pesticide substances/ingredients that were banned for use in those importing countries. (See Beyond Pesticides coverage of the direct export of banned pesticides here and here.)

The study finds that China is the biggest net importer of goods with embodied HLs from insecticides and herbicides, followed by Germany, the UK (United Kingdom), Japan, and India. ("A net importer exerts more environmental pressures (i.e., more pesticide hazard loads) abroad due to their consumption than locally for exports, and vice versa for net exporters.") The U.S. is the largest net exporter of goods with insecticide- and herbicide-embodied HLs, followed by Brazil; 34% of the U.S. HL exports head to China. Roughly 61% of pesticide footprints carried in Brazil's exports is caused by consumption in developed countries, especially the U.S., Germany, and the UK.

The study traces the flows of such embodied pesticide footprints along international trade supply lines, and finds that the biggest flow moves from the U.S. to China, mostly due to soybeans and other grain/legume commodities. As for impacts of human food crops, orchard fruits, and grapes yield the highest footprints (per unit mass and calories), and wheat the lowest. Soybeans show the lowest footprint among protein-rich crops; meat registers a slightly higher footprint per unit.

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Having tracked and quantified the pesticide footprints of commodities as they are exported and imported around the world, the authors conclude: "A reciprocal pesticide regulation may need to be implemented for imports to discourage the consumption of imported commodities produced using the substances banned in the importing country. Countries importing pesticide footprint should also contribute a fair share in the effort to develop technology for sustainable pest management and the implementation of remediation projects to reduce pesticide contamination in exporting countries. To reduce environmental impacts from global food production, our study suggests that, in addition to sustainable pest management strategies that reduce pesticide use, the strategy of shifting human diet towards plant-based foods should be accompanied by the promotion of awareness to minimize food waste and food loss, reduction of overconsumption, and a decrease in the consumption of empty-calorie foods."

The authors make valuable points about the responsibility of countries not to export banned pesticides, about the importance of reducing waste and overconsumption, about the pesticide footprint of nutritionally empty food items, and the advisement of shifting to more plant-based foods in the diets of, especially, developed nations. Yet, as with so much research on which Beyond Pesticides reports, conclusions that argue for "reduction" of pesticide use, "sustainable" pesticide use, integrated pest management (IPM), and the like —though well-intentioned—seem to miss the fundamental point. No incremental "reductions," or IPM, will halt the ubiquitous number and variety of downstream impacts of pesticide use, never mind deal with what has already been deployed. Right now, pesticides are damaging pollinator populations, adding to the human chemical body burden, catalyzing disease processes, launching trophic cascades, degrading agricultural soils, and so much more.

What to do: Only agricultural and other land management practices that eliminate petrochemical pesticides and fertilizers—what in the U.S. is called organic production—would stop the toxic flow of pesticides, many of which have never undergone adequate risk evaluations. Advocate for the transition to organic regenerative agriculture, and other benign land management approaches. You can join/contribute, take up the issue in your local community, organize with others for state-level action, and more; contact Beyond Pesticides for help: info@BeyondPesticides.org or 202.543.5450.

SOURCE: Tang, F.H.M., Malik, A., Li, M. *et al.* International demand for food and services drives environmental footprints of pesticide use. *Commun Earth Environ* 3, 272 (2022). https://doi.org/10.1038/s43247-022-00601-8.

MILITARY EXPOSURE HAZARD: GULF WAR ILLNESS | AMY 24, 2022

Breakthrough Study Shows Organophosphate Nerve Gas Caused Gulf War Illness

Research is providing strong causal evidence that Gulf War Illness (GWI) is the result of exposure to sarin gas, an organophosphate nerve agent used by Saddam Hussein as a chemical weapon during the Gulf War. The findings, published in Environmental Health Perspectives, have important implications for the hundreds of thousands of American service members suffering from a constellation of chronic symptoms without a true understanding of how they became sick. "Quite simply, our findings prove that Gulf War illness was caused by sarin, which was released when we bombed Iraqi chemical weapons storage and production facilities," said Robert Haley, MD, lead author of the study and epidemiologist at University of Texas Southwestern. "There are still more than 100,000 Gulf War veterans who are not getting help for this illness and our hope is that these findings will accelerate the search for better treatment."

Sarin was first synthesized in the late 1930s by Nazi chemists working for IG Farben (a consortium that included Bayer) in an attempt to create stronger and more powerful insecticides. Sarin is a G-series organophosphate (named after the scientists that created them), characterized by high acute toxicity and quick evaporation after release. Exposure to sarin can quickly result in death, though lower levels of exposure have been linked to long-term brain and nervous system impairment. The chemical was identified as a potential chemical weapon, but not used per se during World War II. It was subsequently produced by both the U.S. and USSR during the 1950s. Production ceased near the end of that decade, though stockpiles remained in the U.S. until the 1970s. In the late 1980s, Saddam Hussein used chemical weapons against both Kurdish civilians and Iranian soldiers. Production and stockpiling of sarin was banned under the United Nations Chemical Weapons Convention of 1993.

During the Gulf War, the U.S. military bombed Saddam Hussein's stockpiles of sarin gas. Satellite imagery from the time show that debris plumes from these bombed sites drifted over to American troop positions. Nerve agent alarms were set off at American encampments during the course of the war.

During the Gulf War, the U.S. military bombed Saddam Hussein's stockpiles of sarin gas. Satellite imagery from the time show that debris plumes from these bombed sites drifted over to American troop positions. Nerve agent alarms were set off at certain American encampments during the course of the war.

Veterans dealing with Gulf War Illness have described a range of ongoing symptoms, from fever to fatigue, headaches, night sweats and insomnia, difficulty finding words, issues with concentration and retaining information, sexual dysfunction, respiratory problems, dizziness, skin rashes, joint and body pain and diarrhea and indigestion. The U.S. Department of Veterans Affairs (VA) refers to the illness as a "chronic multisymptom illness."

GWI has been investigated and associated with a range of environmental exposures over the years, including depleted uranium, smoke from oil wells, and other chemicals exposures like carbamates, DEET, and permethrin, used extensively to address pest problems among the deployed. Firm epidemiological data showing causation has been elusive due to scientific scrutiny over recall bias from self-reported exposures, selection bias of studied cohorts, and other potential confounding exposures.

"What makes this new study a game-changer is that it links GWI with a very strong gene-environment interaction that cannot be explained away by errors in recalling the environmental exposure or other biases in the data," Dr. Haley said.

To make their determination, researchers enrolled 1,016 randomly selected veterans deployed during the Gulf War out of over 8,000 that completed a U.S. Military Health Survey. Half of whom developed GWI and half did not. Researchers collected blood and DNA samples from all those enrolled, and completed a questionnaire specifically asking whether—and if so, how often, nerve agent alarms sounded where they were living or working while in Iraq (alarm frequency was used as a measure to gauge exposure amounts).

The enrolled veterans' DNA—in particular, a gene known as paraoxonase-1 (PON1), were analyzed by researchers. Previous research has found PON1 to be a genetic determinant to human susceptibility to organophosphate poisoning. There are two versions of the gene—a "Q" version that produces a blood enzyme that breaks down sarin and an "R" version that can break down other chemicals but does not do well at neutralizing sarin. Individuals may have QQ, QR, or RR genotypes.

Members who put their lives on the line deserve answers regarding how they became sick and meaningful action to treat their illnesses.

Gulf Veteran's PON1 genes tied very closely to risk of GWI. Among service members who heard nerve agent alarms during their deployment, QQ genotypes had a 3.75 fold increase risk of GWI, QR a 4.4 fold increased risk, and RR were 8.9 times likely to develop GWI. These results, adequately addressing a range of confounders while showing a strong 'gold standard' gene-environment interaction, provide a high degree of confidence of causality, according to the researchers. "Your risk is going up step by step depending on your genotype, because those genes are mediating how well your body inactivates sarin," said Dr. Haley. "It doesn't mean you can't get Gulf War illness if you have the QQ genotype, because even the highest-level genetic protection can be overwhelmed by higher intensity exposure. There's no other risk factor coming anywhere close to having this level of causal evidence for Gulf War illness."

Front line service members who put their lives on the line deserve answers regarding how they became sick and meaningful action to treat their illnesses. Far too many veterans of the Vietnam war are still suffering with illnesses caused by exposure to dioxin present in the notorious herbicide Agent Orange. But after fighting in war, sickened service members have found that they must fight a different sort of fight at home for their own health care. Veterans of the Gulf War are likewise still fighting for care. A 2017 Government Accountability Office report found that 80% of Gulf War veteran disability claims are denied by the VA. GWI claims are approved at a rate roughly three times lower than all other potential claimed disabilities. With strong data now on the cause, the VA must move rapidly to ensure American veterans get the treatment they have earned.

As the National Capital Poison Control Center notes, pesticides and nerve agents are similar poisons with similar symptoms. Numerous individuals across the country—many of whom reach out to Beyond Pesticides for assistance—are suffering from a debilitating range of environmentally induced chronic symptoms that affect their ability to function in day-to-day life. This constellation of conditions is often referred to as Multiple Chemical Sensitivity, Idiopathic Environmental Illness, or Toxicant Induced Loss of Tolerance. A recent review by a national team of researchers incorporates GWI into its review of chemical sensitivity conditions, with important findings for wider public health.

What to do: More investment is needed in both epidemiologic approaches to determine the cause of environmental illnesses among service members and the general public, and treatments to address the myriad of chronic conditions one may experience after a triggering exposure. For more information on chemical sensitivities, read a Doris Rapp, MD talk in *Pesticides and You*, and visit the University of Texas, San Antonio website on the Hoffman TILT program.

SOURCE: Robert W. Haley,Gerald Kramer, Junhui Xiao,Jill A. Dever,and John F. Teiber 2022. Evaluation of a Gene–Environment Interaction of *PON1* and Low-Level Nerve Agent Exposure with Gulf War Illness: A Prevalence Case–Control Study Drawn from the U.S. Military Health Survey's National Population Sample. Environmental Health Perspectives 130:5 CID: 057001. https://doi.org/10.1289/EHP9009; University of Texas Southwestern Medical Center press release, Environmental Health Perspectives, (Also See Environmental Health Perspectives editorial on the study).

MALE INFERTILITY | AUGUST 3, 2022

Scientific Literature Review Again Connects Pesticides and Male Fertility Problems

A systematic review of scientific studies on pesticides and fertility finds exposure associated with lower semen quality, DNA fragmentation, and chromosomal abnormalities. Published in the journal Andrology, the review is yet another warning from a long string of researchers sounding the alarm over the connection between global fertility and toxic chemical exposure. With data from the U.S. Centers for Disease Control and Prevention (CDC) indicating roughly one in five couples are unable to conceive after a year of trying, and trends continuing to slope downwards, it is critical that contributing factors be identified so that protective changes can be made.

After screening over 1,300 studies, researchers narrowed their review down to 64 papers assessing semen parameters and DNA integrity after pesticide exposure. Each study is analyzed for its design, the pesticide investigated, the population studied, controls, and reproductive effects determined.

Pesticides are evaluated for their impacts to sperm quality and DNA integrity based on their chemical class. Organochlorine insecticides, which are generally banned but still persistent in soil, air, water, and food in the United States, include a range of impacts to sperm quality. Higher levels of DDT or its breakdown metabolite DDE are associated with lower semen count, and motility and morphology below normal threshold values established by the World Health Organization (WHO). (Under WHO threshold values, a subfertile condition is defined by values lower than the fifth percentile of the general population.) Several studies find that as organochlorine concentrations increase in individual males, sperm parameters also fall. In addition to sperm quality, organochlorines are associated with chromosomal aberrations in several studies, including effects such as sperm disomy, where sperm have extra or missing chromosomes. This can result in viable offspring, but those offspring are at greater risk of abnormalities.

Organophosphate, the class of insecticides that replaced the organochlorines as they were generally phased out, also present a range of deleterious impacts. These chemicals include pesticides like malathion, still widely used, and chlorpyrifos, which is only now being phased out of agricultural use. Effects on sperm parameters are particularly pronounced for individuals in farming regions or with a history of occupational pesticide work. However, studies on the general population also show cause for concern, finding total sperm count and concentrations inversely related to urinary metabolites of organophosphate insecticides. Apart from sperm quality, the literature reveals studies showing organophosphate exposure resulting in missing or extra chromosomes in sperm, with particular attention

paid to diethyl phosphate, a nonspecific organophosphate metabolite.

Synthetic pyrethroids are also singled out in the scientific literature for their links to sperm damage. These are the insecticides that are replacing the organophosphates, as they are being phased out for their myriad health hazards. Unfortunately, the game of whack-a-mole played by the pesticide industry, with EPA's permission, has not resulted in chemicals that are safer for long-term human fertility. Like organophosphates, occupationally exposed individuals are particularly affected, with pyrethroid factory workers showing higher rates of sperm abnormalities and lower motility than nonexposed individuals. Factory workers are also more likely to exhibit DNA fragmentation in their sperm. Another concentration-dependent relationship is found, with individuals reporting higher levels of urinary 3-phenoxybenzoic acid (3-PBA), a nonspecific pyrethroid metabolite, having a lower sperm count, disomy, and a greater chance of exhibiting sperm morphology below WHO thresholds.

Beyond these three classes, scientists did find evidence of negative associations with carbamate class insecticides, fungicides, and herbicides, but the low number of studies does not allow for extensive analysis. Mixtures of various pesticides are cited as having similar effects to the three main pesticide classes investigated though firm results were difficult to specify due to lack of complete information. In general, occupationally exposed workers are most at risk, with chronic exposure being associated with greater sperm defects.

The results of the study are concerning in light of steadily declining sperm counts. A 2017 study found that sperm counts since 1973 have fallen by nearly 60%. One author of that study, Shanna Swan, PhD, captured public attention regarding sperm declines through her book Countdown, which goes into great depth regarding the impact of environmental chemicals on human fertility. Watch Dr. Swan's talk, Modern Life and the Threat to the Future, at Beyond Pesticides' 2021 National Forum, *Cultivating Healthy Communities*.

Researchers have been sounding the alarm on the impact of pesticides on fertility for decades. In 2013, a previous literature review evaluating pesticide impacts on fertility found pesticides strongly associated with declines in sperm count. As she recounted at the 2021 Forum, Dr. Swan's own work is borne out of efforts to try to disprove a paper published in 1992 by Carlsen et al., which highlights significant declines in sperm quality since the late 1930s.

What to do: As the human civilization grapples with a range of cascading crises, from climate change to the insect apocalypse and global biodiversity crisis, we may be missing the chance to address one of the most critical aspects to the continuation of humanity as we now know it. For more information on the fertility crisis, see Dr. Swan's presentation to the National Pesticide Forum on Beyond Pesticides' Youtube page. Share the presentation with your community to advance organic land management of parks and playing fields.

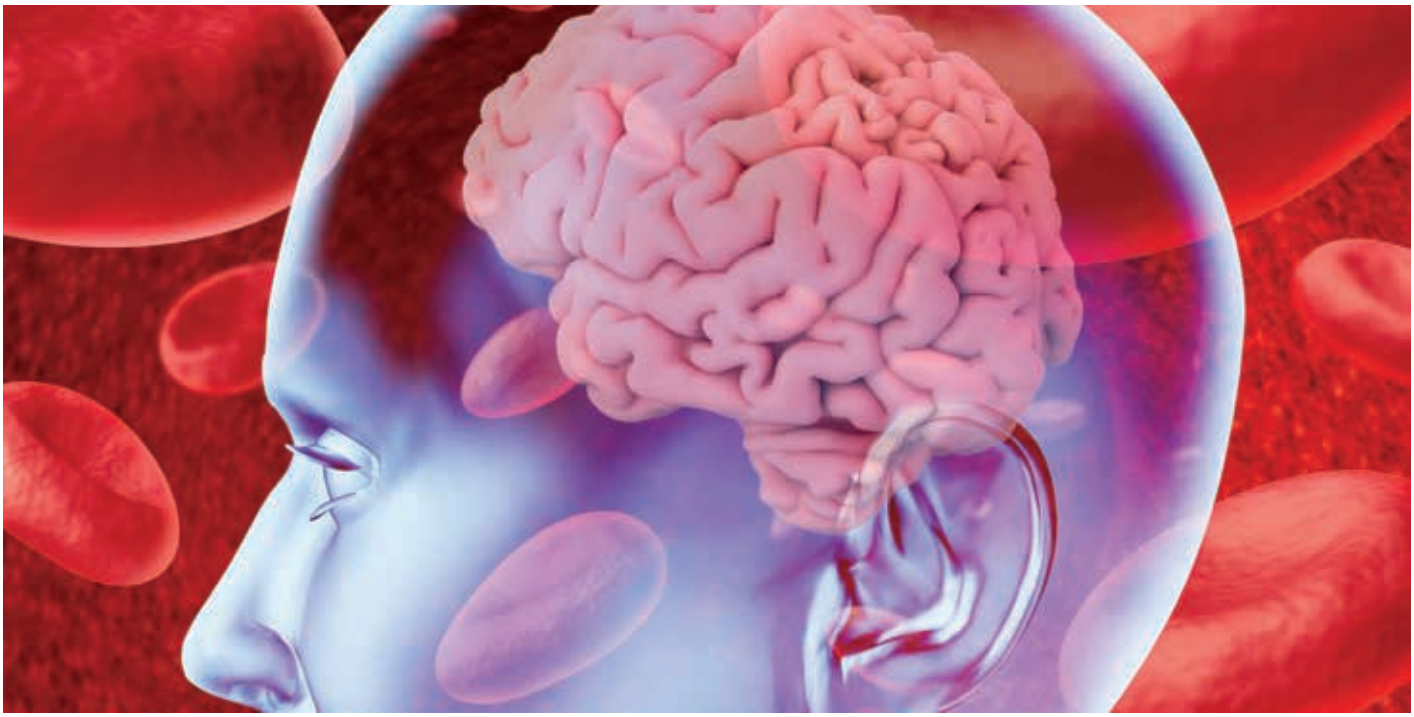
SOURCE: Giulioni, C, Maurizi, V, Castellani, D, et al. The environmental and occupational influence of pesticides on male fertility: A systematic review of human studies. *Andrology*. 2022; 10: 1250– 1271. https://doi.org/10.1111/andr.13228.

ALZHEIMER'S/NEURODEGENERATIVE DISEASE | AUGUST 4, 2022

Glyphosate Weed Killer Crosses Blood-Brain Barrier, Linked to Alzheimer's and Other Neurodegenerative Diseases

An Arizona State University (ASU) study, published in the *Journal of Neuroinflammation*, shows that the popular herbicide glyphosate can infiltrate the brain through the blood (blood-brain barrier), increasing neurological disease risk. The blood-brain barrier filters various molecules entering the brain from the circulatory system. However, the permeation of glyphosate molecules elevates the expression of TNFα and the accumulation of soluble beta-amyloid (Aβ) proteins in the brain and has associations with immune, inflammatory, and neurodegenerative diseases, like Alzheimer's disease (AD).

More than six million people in the U.S. are living with Alzheimer's, and cases are expected to double by 2050. Although Alzheimer's research has focused heavily on finding genetic causes of the disease, fewer than half of cases are genetic. Thus, researchers are now evaluating how environmental contaminants may increase disease risk. Over 300 environmental contaminants and their byproducts, including pesticides, are chemicals commonly present in human blood and urine samples and can increase neurotoxicity risk when crossing the brain barrier. Therefore, studies like this highlight the importance of understanding how chemical accumulation in the body can impact long-term health and disease prognosis. The study notes, "Brain glyphosate correlates with increased TNFα levels, suggesting that exposure to this herbicide may trigger neuroinflammation in the brain, which may induce changes that are seen in neurodegenerative disorders. […] Collectively, given that a large subset of the population may be exposed to this chemical agent, these results raise



awareness of the detrimental effects glyphosate exposure may have on the brain and human health."

Several studies demonstrate that glyphosate is detectable in the brain tissue of animals. However, this research investigates if persistent exposure to glyphosate leads to detectability in brain tissue and how the chemical's presence affects TNFα levels in the brain. Using urine, plasma, and brain samples from mice in the study, researchers examined gene expression associated with dose-dependent exposure to glyphosate. Moreover, the study employs a novel one-step glyphosate extraction method using liquid chromatography-mass spectrometry (LC-MS)-based quantification to measure the level of glyphosate and its breakdown product aminomethylphosphonic acid (AMPA) in brain tissues. The results confirm that glyphosate infiltrates brain tissue, elevating TNFα levels and soluble Aβ, causing cell death among exposed cortical neurons. The novel one-step glyphosate extraction method provides the first evidence of dose-dependent glyphosate accumulation in the brain. Moreover, the extraction method finds a small amount of AMPA in brain tissue, indicating glyphosate is also breaking down in the body. Therefore, glyphosate exposure has implications for neurodegenerative diseases like AD, resulting from elevated protein levels and expression.

The nervous system is an integral part of the human body and includes the brain, spinal cord, and a vast network of nerves and neurons, all of which are responsible for many bodily functions—from sensation to movement. However, exposure to chemical toxicants, like pesticides, can cause neurotoxic effects or exacerbate preexisting chemical damage to the nervous system. The impacts of pesticides on the nervous system, including the brain, are hazardous, especially for chronically exposed individuals (e.g., farmworkers) or during critical windows of vulnerability and development (e.g., childhood, pregnancy). Mounting evidence over the past years shows that chronic exposure to sublethal (low) levels of pesticides adversely affects the central nervous system (CNS) and neural receptors, such as connections between nerves, the brain, enzymes, and DNA. Specifically, researchers identify agricultural chemical exposure as a cause of many adverse CNS impacts and neurological diseases, including Alzheimer's, amyotrophic lateral sclerosis (ALS), and Parkinson's disease. Therefore, advocates say it is essential to avoid toxic chemical exposure to lessen potential acute and chronic health risks.

The study highlights that glyphosate crosses the blood-brain barrier in vitro (in an artificial environment outside the body), but this study verifies this in vivo (in a living organism). Glyphosate exposure increases inflammatory cytokine proteins in the blood, especially TNFα. The overexpression of the TNFα protein has associations with cancer, rheumatoid arthritis, psoriasis, multiple sclerosis, and other diseases. Although this study adds to the growing body of research on pesticide neurotoxicity, it is the first to demonstrate that glyphosate successfully crosses the blood-brain barrier, accumulating in the brain in a dose-dependent manner.

However, this is not the first time that toxic compounds have been shown to transfer from the blood to other organs and vice versa. Several studies find pesticide compounds in a mother's blood can transfer to the fetus via the umbilical cord. Furthermore, a 2021 study finds

that pregnant women already have over 100 detectable chemicals in blood and umbilical cord samples, including banned persistent organic pollutants (POPs). However, 89 percent of these chemical contaminants are from unidentified sources, lack adequate information, or were not previously detectable in humans.

Pesticides, themselves mixtures of chemicals such as Agent Orange or dioxins, and therapeutic hormones or pharmaceutical products, possess the ability to disrupt neurological function. These chemicals can pass through the skin (dermal) and mucosal membranes, including the lungs (inhalation) and gut (ingestion), and into blood circulation. For instance, studies suggest pesticide formulants (adjuvants), such as POEA (polyoxyethylene tallow amine), have neurotoxic activity. POEA is present in some glyphosate-based herbicides like Roundup and contributes to nervous system toxicity with the active ingredient (glyphosate).

The study concludes, "While there are many correlations between glyphosate and various illnesses, our goal is to shed light on the correlation between glyphosate application and AD [Alzheimer's diseases]. Future work will focus on uncovering the molecular overlap between glyphosate exposure and AD pathology. Specifically, we will focus on determining if glyphosate exposure is capable of exacerbating amyloid [Aβ] pathology and inducing cell death, in vivo in mouse models of AD."

There is a lack of complete understanding of the etiology of pesticide-induced diseases, including predictable lag time between chemical exposure, health impacts, and epidemiological data. Pesticides themselves can possess the ability to disrupt neurological function. Pesticides' impact on the nervous system, including the brain, are hazardous, especially for chronically exposed individuals or during critical windows of vulnerability and development. Therefore, studies related to pesticides and neurological disorders can help scientists understand the underlying mechanisms that cause neurodegenerative diseases. Although occupational and environmental factors, like pesticides, adversely affect human health, regulatory reviews are plagued by numerous limitations in defining real-world poisoning, as captured by epidemiologic studies in Beyond Pesticides' Pesticide-Induced Diseases Database (PIDD) and Daily News Blog. The adverse health effects of pesticides, exposure, and the aggregate risk of pesticides showcase a need for more precise research surrounding occupational and residential pesticide exposure in order to make complete determinations and fully recognize uncertainty in regulatory decisions that are precautionary.

What to do: Existing information, including this study, supports the clear need for a strategic shift away from pesticide dependency. For more information on the effects of pesticide exposure on neurological health, see Beyond Pesticides' PIDD pages on brain and nervous system disorders, including dementia-like diseases, such as Alzheimer's, and other impacts on cognitive function. Alzheimer's disease has no cure, but preventive practices like organics can eliminate exposure to toxic AD-inducing pesticides. Organic agriculture represents a safer, healthier approach to crop production that does not necessitate pesticide use. Beyond Pesticides encourages farmers to embrace regenerative, organic practices. A complement to buying organic is contacting various organic farming organizations to learn more about what you can do.

SOURCE: Winstone, J.K., Pathak, K.V., Winslow, W. *et al.* Glyphosate infiltrates the brain and increases pro-inflammatory cytokine TNFα: implications for neurodegenerative disorders. *J Neuroinflammation* 19, 193 (2022). https://doi.org/10.1186/s12974-022-02544-5 Arizona State University.

THYROID CANCER | AUGUST 26, 2022

As Thyroid Cancer Cases Rise, Study Finds Pesticide Link

Research from a team in California finds one-third of pesticides it reviewed—including glyphosate, paraquat dichloride, and oxyfluorfen—to be associated with the development of thyroid cancer. Researchers investigated the links between exposure to pesticides—including 29 that cause DNA cell damage—and the risk of this cancer. The researchers also find that in all the single-pollutant models they employed, paraquat dichloride—a widely used herbicide—is linked to this cancer. In 2021, Beyond Pesticides covered research by the U.S. National Institutes of Health (NIH) that demonstrated that exposures to lindane and metalaxyl also cause heightened risk of thyroid cancer. These study findings add to the already considerable concern about pervasive pesticide exposure—not only among farmers and applicators, but also in the general population.

It is worth noting that, in addition to elevated thyroid cancer risks, multiple pesticides can cause other health damage. Paraquat is also acutely toxic, and can cause longer-term reproductive, renal, and hepatic damage to humans; it is toxic to birds, fish, and other aquatic organisms, and slightly so to honeybees. Glyphosate, as Beyond Pesticides has written frequently, is carcinogenic, and is associated with human, biotic, and ecosystem harm. Oxyfluorfen exposures deliver risk of reproductive, renal, hepatic, and developmental damage to humans, and toxicity to fish and other aquatic creatures.

The research team, from the University of California (UC) Los Angeles Health Sciences, published its study in *The*

Journal of Clinical Endocrinology & Metabolism. The authors say it "provides the first evidence supporting the hypothesis that *residential* pesticide exposure from agricultural use is associated with an increased risk of thyroid cancer" [emphasis by Beyond Pesticides].

Thyroid cancer is one of the few cancers whose incidence has risen in recent decades—by 3% since 1992, according to *Science Daily's* reporting on the California research. The American Thyroid Association also notes the dramatic increase in incidence, and says thyroid cancer is now the fastest-growing cancer in women, with most of that increase representing papillary thyroid cancer (the most common and slowest-growing of the subtypes).

Some of the increased incidence is likely attributable to better detection methods and increased use of imaging in health care. While genetics certainly play a role in vulnerability to thyroid disease generally, widespread exposures to certain pesticides—whether through residues in the food supply, occupational exposures, or as in the subject study, residence in an agricultural production area—appear to pose a real risk for the development of thyroid cancers.

While genetics certainly play a role in vulnerability to thyroid disease generally, widespread exposures to certain pesticides—whether through residues in the food supply, occupational exposures, or as in the subject study, residence in an agricultural production area—appear to pose a real risk for the development of thyroid cancers.

A *Scientific American* article notes that 20 years ago, a study published in the *American Journal of Epidemiology* found that "Iowa and North Carolina women married to men using such pesticides as aldrin, DDT and lindane were at much higher risk of developing thyroid disease than women in non-agricultural areas"—at an incidence rate of 12.5%, compared to a 1–8% rate in the general population. [Note: the organochlorine pesticides aldrin and DDT were banned by the U.S. Environmental Protection Agency in 1974 and 1972, respectively.]

Beyond Pesticides was quoted in that study article: "It's not just farm women who should worry. Trace amounts of chemical pesticides and fertilizers most certainly end up in some of the food we eat. The nonprofit group Beyond Pesticides warns that some 60 percent of pesticides used today have been shown to affect the thyroid gland's production of T3 and T4 hormones. Commercially available insecticides and fungicides have also been implicated."

The UC researchers did not need to stray far for their study; they focused on roughly 25% of all pesticides deployed in the U.S. (The state has been experiencing an uptick in advanced thyroid cancer diagnoses.)

The team used data from the California Cancer Registry (for 1999–2012) to examine residential exposure to 29 agricultural pesticides that cause DNA damage or endocrine disruption (ED) and used GIS (geographic information system) data to identify reasonable exposure estimates for each participant. The study sample comprised 2,067 thyroid cancer cases and 1,003 control

participants. All study participants were at least 35 years old, had a thyroid cancer diagnosis, and lived in the study's target geographic area at the time of diagnosis. Control subjects were also at least 35, lived in that same geographic area, and had been living in California for at least five years before the research interview.

Principal investigator Avital Harari, M.D., pointed to the increased incidence of thyroid cancer and implications of the study's findings. She said, "[T]he risk of advanced thyroid cancers, which can increase risk of mortality and cancer recurrence, has been found to be higher in the state of California as compared to other states. Therefore, it is essential to elucidate risk factors for getting thyroid cancer and understand potentially alterable causes of this disease in order to decrease risks for future generations. . . . Our research suggests several novel associations between pesticide exposure and increased risk of thyroid cancer. Specifically, exposure to the pesticide paraquat is positively associated with thyroid cancer risk." She cites additional findings: that exposures to other pesticides, in combination with those to paraquat (in multi-pollutant models) also suggest increased thyroid cancer risk, and that exposures (over a 20-year period) to a larger number of unique pesticides proportionately increase the cancer risk.

Most previous research has focused on the role of endocrine-disrupting pesticides in the development of thyroid cancer, or disease development among those exposed occupationally (e.g., in this research, this, and this). The pesticides metalaxyl and lindane, both established endocrine disruptors, have been implicated in heightened thyroid cancer risk across multiple studies, including the NIH study mentioned above. See more, older research on Beyond Pesticides' Pesticide-Induced Diseases Database webpage, in the section on thyroid cancer.

The *Science Daily* coverage of the UC study explains further that "certain pesticides are established mutagens or have been shown to induce tumor growth and chromosomal abnormalities in vitro. These include glyphosate—the active ingredient in widely used herbicides—and pesticides that induce DNA cell damage in vitro. Pesticides also can alter thyroid hormone production, which has been associated with thyroid cancer risk."

Threats to public health—in the subject study, from pesticides associated with development of thyroid cancer, but from toxic pesticides and chemicals far more broadly—are not being adequately mitigated by governments at federal, state, or local levels. And those threats are certainly not front and center in the business models of the agrochemical companies that manufacture pesticide products.

The relevant methods of action of pesticides re: thyroid cancer are the mutagenic or the (less direct) endocrine disrupting. The actions of endocrine disruptors were laid out by Beyond Pesticides in 2021: "'The ingredients in many pesticides (and in many consumer products) act as endocrine disruptors in humans and other animals in several ways. They may: (1) mimic actions of hormones the body produces (e.g., estrogen or testosterone), causing reactions similar to those generated by the naturally produced hormones; (2) block hormone receptor cells, thereby preventing the actions of natural hormones; or (3) affect the synthesis, transport, metabolism, and/or excretion of hormones, thus altering the concentrations of natural hormones in tissues or at receptor sites.' Pesticides acting as EDs can . . . distort hormone levels in the body."

Threats to public health—in the subject study, from pesticides associated with development of thyroid cancer, but from toxic pesticides and chemicals far more broadly—are not being adequately mitigated by governments at federal, state, or local levels. And those threats are certainly not front and center in the business models of the agrochemical companies that manufacture pesticide products. Thus, the onus for changing the U.S. system of allowing toxic chemical use without adequate, precautionary, and protective review falls on the public and its organizational health, environment, climate (and other) advocates—such as Beyond Pesticides and many, many others.

What to do: Our involvement, whether as professionals, laypeople, elected officials, or concerned advocates, is critical to enhancing public understanding of the science that underlies the current health, biodiversity, and climate crises, and to motivating action on the local, state, and national levels. These crises arise from a confluence of issues, and are harming all life and every environment on the planet. The need for *carefully defined sustainable* land management, building and household practices, and consumer and industrial products is urgent. The 2022 National Forum Series launched Beyond Pesticides' campaign to eliminate fossil fuel-based pesticide use within the next decade—putting a stop to toxic emissions, exposure, and residues, while embracing an organic systems approach that is holistic and respectful of life.

SOURCE: Negar Omidakhsh, Julia E Heck, Myles Cockburn, Chenxiao Ling, Jerome M Hershman, Avital Harari. Thyroid Cancer and Pesticide Use in a Central California Agricultural Area: A Case Control Study. *The Journal of Clinical Endocrinology & Metabolism*, 2022 107 (9): e3574 DOI: 10.1210/clinem/dgac413; Science Daily

ENDOCRINE DISRUPTION | NOVEMBER 25, 2022

Hormone Mimicking Properties of Glyphosate Weed Killer and Related Compounds Increase Breast Cancer Risk

A study published in *Chemosphere* adds to the growing body of research that demonstrates the role that endocrine (hormone) disrupting effects of glyphosate play in breast cancer development. Exposure to the herbicide glyphosate and other glyphosate-based herbicides (GBHs) at high concentrations mimics the estrogen-like cellular effects of 17β-estradiol (E2), altering binding activity to estrogen receptor α (ERα) sites, thus causing fundamental changes in breast cancer cell proliferation (abundance).

Glyphosate is the most commonly used active ingredient worldwide, appearing in many herbicide formulas, not just Bayer's (formerly Monsanto) Roundup®. The use of this chemical has been increasing since the inception of crops genetically modified to tolerate glyphosate over two decades ago. The toxic herbicide readily contaminates the ecosystem with residues pervasive in food and water commodities. In addition to this study, the scientific literature shows time and time again that glyphosate has an association with cancer development, as well as human, biotic, and ecosystem harm. Therefore, advocates point to the need for national policies to reassess hazards associated with disease development and diagnosis upon exposure to chemical pollutants. The researchers note, "The results obtained in this study are of toxicological relevance since they indicate that glyphosate could be a potential endocrine disruptor in the mammalian system. Additionally, these findings suggest that glyphosate at high concentrations may have strong significance in tamoxifen [breast cancer drug] resistance and breast cancer progression. [F]urther studies in animal models must confirm these effects on organ systems."

The study evaluates the cytotoxic (toxic to cells) effect of analytical grade glyphosate and GBHs to evaluate its estrogenic activity. The literature shows that significant exposure to these GBHs can cause cell death from the active ingredient glyphosate, as well as other ingredients in the formulations. These ingredients can have detergent-like properties (e.g., adjuvants) that can amplify the cytotoxic effects of glyphosate. The researchers aim to clarify the molecular mechanism involved in glyphosate-induced estrogen production and breast cancer cells. The Chilean researchers in the study find exposure to glyphosate at high concentrations induces estrogen-like effects through binding to estrogen receptor α (ERα) sites, mimicking the cell effects of 17β-estradiol (E2), attaching a phosphate group to the zinc (Zn) II ion (phosphorylation), thus causing fundamental changes

to estrogen in breast cancer cells. Like past studies, this study demonstrates that glyphosate mimics the effect of E2 through Erα phosphorylation.

Breast cancer is the most common cancer among women, causing the second most cancer-related deaths in the U.S. Past studies suggest that genetic inheritance factors influence breast cancer occurrence. However, genetic factors only play a minor role in breast cancer incidents, while exposure to external environmental factors (i.e., chemical exposure) may play a more notable role. According to the Centers for Disease Control and Prevention (CDC), breast cancer is a disease that causes breast cells to grow out of control, with the type of breast cancer depending on the cells themselves. Most common forms of breast cancer have receptors on the cell surface that can increase cancer growth when activated by estrogen, progesterone, or too much of the protein called HER2. Hormones generated by the endocrine system greatly influence hormone cancer incidents among humans (e.g., breast, prostate, and thyroid cancers). Several studies and reports, including U.S. Environmental Protection Agency (EPA) data, identify hundreds of chemicals as influential factors associated with breast cancer risk. One in ten women will receive a breast cancer diagnosis, and genetics can only account for five to ten percent of cases. There are grave concerns over exposure to endocrine (hormone) disrupting chemicals and pollutants that produce adverse health effects. Considering not only glyphosate but over 296 chemicals in consumer products can increase breast cancer risk through endocrine disruption, it is essential to understand how chemical exposure impacts chronic disease occurrence.

Advocates argue that global leaders must fully understand the cause of pesticide-induced diseases before the chemicals enter the environment. Policy reform and practices that eliminate toxic pesticide use can end the uncertainty surrounding potential harm.

Glyphosate has been the subject of a great deal of public advocacy and regulatory attention and is the target of thousands of lawsuits. Beyond Pesticides has covered the glyphosate tragedy extensively; see its litigation archives for multiple articles on glyphosate lawsuits.

Several studies link pesticide use and residue to various cancers, from more prevalent forms like breast cancer to rare ones like kidney cancer nephroblastoma (Wilms' tumor). Although the connection between pesticides and associated cancer risks is nothing new, past studies suggest glyphosate and GBHs act as endocrine disruptors, affecting the development and regulation of estrogen hormones that promote breast cancer. However, this study is one of the few to evaluate the molecular mechanisms involved in toxicological changes initiating breast cancer events. Phosphorylation with a Zn (II) ion stabilized the bond between the estrogen-imitating activity of glyphosate and GBHs to the Erα. Therefore, the bond promotes the overexpression of estrogen-sensitive genes, increasing consequences on breast cancer cell activity. The study concludes, "The results obtained in this study are of toxicological relevance since they indicate that glyphosate could be a potential endocrine disruptor in the mammalian system."

Cancer is a leading cause of death worldwide. Much pesticide use and exposure are associated with cancer effects. Studies concerning pesticides and cancer help future epidemiologic research understand the underlying mechanisms that cause cancer. Although the link between agricultural practices and pesticide-related illnesses is stark, over 63 percent of commonly used lawn pesticides and 70 percent of commonly used school pesticides have links to cancer.

Advocates argue that global leaders must fully understand the cause of pesticide-induced diseases before the chemicals enter the environment. Policy reform and practices that eliminate toxic pesticide use can end the uncertainty surrounding potential harm. For more information on the harms of pesticides, see Beyond Pesticides' Pesticide-Induced Diseases Database pages on breast cancer, endocrine disruption, and other diseases. This database supports the need for strategic action to shift away from pesticide dependency.

What to do: Prevention of the causes of breast cancer, not just awareness, is critical to solving this disease. In 1985, Imperial Chemical Industries and the American Cancer Society declared October "Breast Cancer Awareness Month" as part of a campaign to promote mammograms for the early detection of breast cancer. Unfortunately, most people are all too aware of breast cancer. Detection and treatment of cancers do not prevent the problem. EPA should evaluate and ban endocrine-disrupting pesticides and make organic food production and land management the standard that legally establishes toxic pesticide use as "unreasonable."

Moreover, proper prevention practices, like buying, growing, and supporting organics, can eliminate exposure to toxic pesticides. Organic agriculture has many health and environmental benefits that curtail the need for chemical-intensive agricultural practices. Regenerative organic agriculture nurtures soil health through organic carbon sequestration while preventing pests and generating a higher return than chemical-intensive agriculture. For more information on how organic is the right choice, see the Beyond Pesticides webpage, Health Benefits of Organic Agriculture.

SOURCE: Juan P. Muñoz, Rocío Araya-Osorio, Raúl Mera-Adasme, Gloria M. Calaf, Glyphosate mimics 17β-estradiol effects promoting estrogen receptor alpha activity in breast cancer cells, Chemosphere, Volume 313, 2023, 137201, ISSN 0045-6535, https://doi.org/10.1016/j.chemosphere.2022.137201.

HAZARDOUS INERT INGREDIENTS UNDERREGULATED | AUGUST 9, 2022

"Inert" Pesticide Ingredients and Failure to Regulate Raise Dangers for All U.S. Residents

The most widely used pesticide chemicals in the United States are not listed on product labels, yet pose widespread environmental and public health hazards, according to commentary published this month in *Environmental Health Perspectives* by two veteran researchers. At issue are adjuvants and so-called "inert" (or "other") ingredients, chemicals that are added to formulated pesticide products, but do not undergo the same safety reviews as the active ingredient in pesticide products. This donut hole of regulation has permitted, as the commentary shows, millions of pounds of chemicals to be applied in California and throughout the country without proper scientific evaluation of their human health or ecological impact.

Researchers first draw a distinction between adjuvant products and inert ingredients in pesticide products. Adjuvants are materials specifically designed to improve the performance of a pesticide spray and are sold separately from formulated pesticide products. Adjuvants are "tank mixed" with a pesticide prior to its application. Inert ingredients are any ingredient within a formulated pesticide product that is not designed to prevent, destroy, or repel a pest. Adjuvants and inert ingredients can be the same material—the difference lies in when they are added to a formulated pesticide product and the claimed purpose of their use. This distinction is important because researchers utilize data from California's pesticide reporting system for their review. In California, pesticide adjuvants are required to be registered as pesticides, and their use reported to the state on a monthly basis. The U.S. Environmental Protection Agency (EPA) does not require this, nor does any other state than California. In California and throughout the country, inert ingredients are minimally reviewed by EPA and added to an inert ingredient database. Pesticide manufacturers can use any inert ingredient in EPA's inert ingredient database without disclosing that material on the pesticide product label. There are no reporting requirements for inert ingredients in any state.

Pesticide manufacturers can use any inert ingredient in EPA's inert ingredient database without disclosing that material on the pesticide product label. There are no reporting requirements for inert ingredients in any state.

An evaluation of California's pesticide reports finds that among all pesticides and adjuvants registered, 37 of the 100 most widely used pesticides in California are adjuvants. Researchers subsequently zeroed in on the most

used material, the adjuvant α-(*p*-nonylphenyl)-ω-hydroxypoly(oxyethylene) (APNOHO). Over 10 million acres of agricultural land in California is sprayed with APNOHO each year. The chemical is a nonionic surfactant, used to increase the penetration of an active ingredient in attempts to improve a pesticide's performance. In addition to its registration as an adjuvant in over 150 adjuvant products in California, a freedom of information act request to EPA uncovered it being used as an inert ingredient in over 650 federally registered fully formulated pesticides (including insecticides, herbicides, and fungicides).

With no oversight of this chemical, APNOHO use in California has more than doubled over the past 20 years, from just over one million pounds per year in 2000 to 2.2 million pounds in 2019. APNOHO and other chemicals in its class are applied to nearly 12 million acres of farmland in California each year. Between its use as an adjuvant and inert ingredient in other states, there is no telling how much of this chemical U.S. residents are being exposed to each year.

The widespread use of this material raises a range of health and environmental worries. APNOHO is considered an endocrine (hormone) disrupting chemical by the European Union, yet despite a recent damning report from the EPA Office of Inspector, the U.S. lags far behind in its safety evaluations of these concerning impacts. Out of over 1,300 chemicals that require testing, EPA has issued orders for a scant 52. An analysis in the commentary finds that the little data EPA has produced on APNOHO indicates its hormone disrupting activity is more potent than the active pesticide ingredients and known endocrine disruptors methoxychlor and vinclozolin.

Endocrine disruptors pose a growing risk to the American public; one that is increasing due to a lack of regulation by EPA. These materials function by: (i) mimicking the action of a naturally-produced hormone, such as estrogen or testosterone, thereby setting off similar chemical reactions in the body; (ii) blocking hormone receptors in cells, thereby preventing the action of normal hormones; or (iii) affecting the synthesis, transport, metabolism and excretion of hormones, thus altering the concentrations of natural hormones. Endocrine disruptors have been linked to attention deficit hyperactivity disorder (ADHD), Parkinson's and Alzheimer's diseases, diabetes, cardiovascular disease, obesity, early puberty, infertility and other reproductive disorders, childhood and adult cancers, and other metabolic disorders.

Regulators and policymakers are urged to consider health and environmental effects that result from combinations of pesticides, adjuvants, and inert ingredients. It is further recommended that officials in states other than California require registration of pesticide adjuvants.

In addition to effects on the body's hormonal system, APNOHO is associated with increased risk of birth defects in laboratory and epidemiological studies, including one paper that shows a doubled risk for the birth defect craniosynostosis. The chemical likewise poses significant environmental hazards, with data showing harm to aquatic life greater than that caused by the neonicotinoid insecticide imidacloprid. Researchers note that APNOHO is considered hazardous within other U.S. laws, including the Toxic Release Inventory and *Clean Air Act.*

To better understand the implications of the widespread use of APNOHO and other inerts and adjuvants, the commentary suggests recommendations both for other researchers and policymakers. For researchers, it is suggested that adjuvants and inerts be included in epidemiological studies, chemical abstract service (CAS) numbers be included for all ingredients in all pesticide products studied (if unable to discern up front, analytical techniques should be employed to find and identify all ingredients to the greatest extent possible), and all pesticides, inert ingredients, and adjuvants should be evaluated for endocrine-disrupting activity.

Regulators and policymakers are urged to consider health and environmental effects that result from combinations of pesticides, adjuvants, and inert ingredients. It is further recommended that officials in states other than California require registration of pesticide adjuvants. Lastly, the authors note that it has been 25 years since the American Medical Association recommended that pesticide products contain all ingredients on their labels and safety data sheets, making these steps long overdue.

"In the past, improving public access to data about emissions of toxic chemicals has prompted important health and safety improvements," the authors note, referencing the impact of Toxic Release Inventory data in prompting updates to the *Clean Air Act.*

What to do: Beyond Pesticides is strongly in favor and has been consistently active in efforts to push EPA to fulfill its statutory obligations to review endocrine-disrupting pesticides and increase public health transparency by disclosing all ingredients in pesticide formulations. Take action today to tell EPA to regulate hormone disruption chemicals, and Congress to pass the *Protect America's Children from Toxic Pesticides Act* (PACTPA), which would require label disclosure of all inert ingredients in a pesticide.

SOURCE: Caroline Cox and Michael Zeiss. 2022. Health, Pesticide Adjuvants, and Inert Ingredients: California Case Study Illustrates Need for Data Access. Environmental Health Perspectives 130:8 CID: 085001 https://doi.org/10.1289/EHP10634; EHP Invited Commentary)

COVID: ELEVATED DISINFECTANT HAZARDS | FEBRUARY 1, 2022

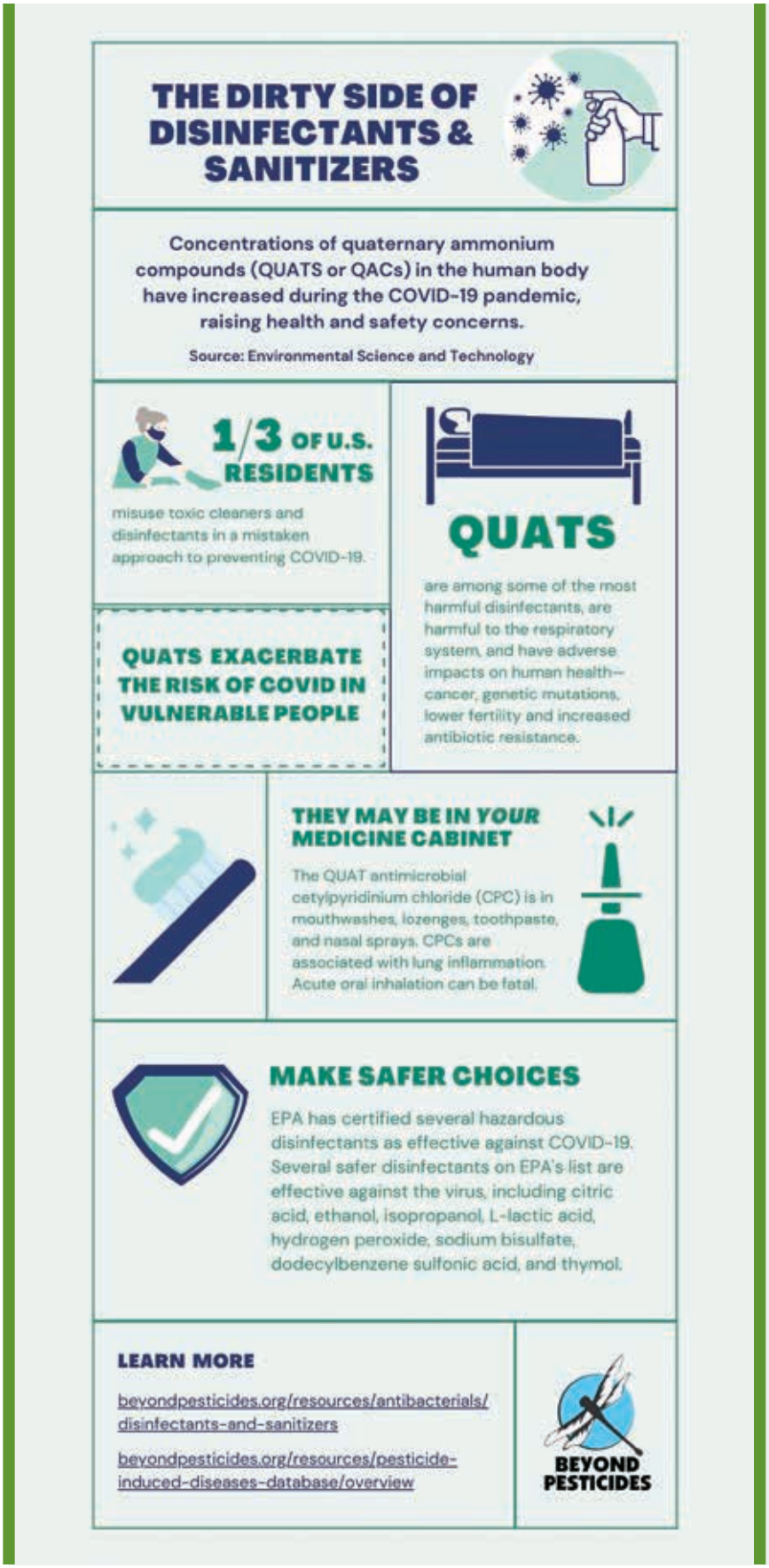
Increased Accumulation of Disinfectant Chemicals in the Body During the Pandemic Threatens Health, Despite Available Alternatives

A study published in *Environmental Science and Technology* finds that concentrations of quaternary ammonium compounds (QUATs or QACs) in the human body have increased during the Covid-19 pandemic, raising health and safety concerns. QACs include a variety of chemicals in personal care, pharmaceutical, and medical products used as disinfectants, sanitizers, antimicrobials. However, over the past 70 years, large-scale production and use of these compounds led to accumulation in the environment, including surface water, sediment, and soil.

Previously, researchers thought most QACs lack the potential to bioaccumulate, as the chemicals are highly water soluble, while dermal and oral absorption rates are low. However, emerging evidence demonstrates that specific QACs bioaccumulate in blood and other body tissues and can cause a range of toxic effects. Therefore, studies like this highlight the significance of monitoring chemical exposure for adverse health effects. The researchers note, "Further efforts are needed to explore the relationship between the use of QAC-containing products and the levels of QACs in human blood or of their metabolites in urine. Considering the increased use of some QACs as a result of the Covid-19 pandemic, our findings warrant further exposure and epidemiological research focused on QACs."

The World Health Organization (WHO) and other infectious disease specialists condemn indiscriminate and vast amounts of disinfectant spraying in public areas, deeming it ineffective and a health hazard on contact or when combined with other disinfectants.

Amidst 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 disinfecting highly trafficked areas as the most effective way to combat Covid-19. This notion has led to dangerous disinfecting practices in many countries where trucks, drones, or robots disperse massive amounts of disinfectants into public areas. Furthermore, the Centers for Disease Control and Prevention (CDC) has reported a sharp increase in calls to Poison Control Centers regarding illnesses resulting from the use or misuse 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,



deeming it ineffective and a health hazard on contact or when combined with other disinfectants.

The researchers performed an in vitro—in vivo extrapolation (IVIVE) model to determine the bioaccumulation potential of 18 QACs in blood samples from the liver before (2019) and during (2020) the Covid-19 pandemic. The model determines the clearance rate in vivo (in the body), in which a slower clearance rate means higher bioaccumulation potential. The results show 15 out of the 18 QACs are detectable in blood samples, with QAC concentrations significantly higher during the pandemic than prior to it. The main routes of exposure include diet, inhalation, ingestion, or the skin.

More than a third of U.S. residents participate in high-risk Covid-19 practices, misusing toxic disinfectant cleaners and disinfectants to prevent infection. Quaternary ammonium compounds are among some of the most harmful disinfectants, as their "long-lasting" properties have adverse impacts on human health, which has extensive documentation in the scientific literature. Effects include mutations, lower fertility, and increased antibiotic resistance. The overuse of QAC disinfectants in U.S. Immigration and Custom Enforcement (ICE) detainment centers causes nose bleeds and other adverse health effects.

Furthermore, Beyond Pesticides receives questions from concerned teachers asking for less harmful disinfectants to use in the classroom, especially as many are experiencing adverse impacts of disinfectant use (e.g., chemical skin burns, respiratory issues). Since QACs are in most disinfectant products, it remains ubiquitous in the environment as misuse continues.

Although disinfectants, like QACs, kill viruses, bacteria, and other microbes via cell wall and protein destruction, they can also negatively affect the immune system, thus reducing resistance to disease. People who have a preexisting condition or are of advanced age, who may have a weakened immune or respiratory system, are more vulnerable to

the effects of the virus. When managing viral and bacterial infections, chemicals that exacerbate the risk to vulnerable individuals are of serious concern.

QACs are harmful to the respiratory system and have a long list of adverse effects, from cancer and genetic mutations to lower fertility and increased antibiotic resistance. Most recently, the QAC antimicrobial cetylpyridinium chloride (CPC) has raised concerns. The compound is present in mouthwashes, lozenges, toothpaste, and nasal sprays and is thus commonly encountered orally. A recent study finds CPCs have associations with adverse respiratory effects (e.g., lung inflammation). Moreover, acute oral inhalation can be fatal. Although CPC also has uses as an "inert" or undisclosed ingredient in pesticide products, recent findings demonstrate CPC has more biological potential. 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. Considering Covid-19 is a systemic (general) disease that overwhelmingly impacts the respiratory system of many patients, exposure to CPCs present a heightened risk of co-occurring symptoms. Damage to the respiratory system can also trigger the development of extra-respiratory systemic manifestations like rheumatoid arthritis, and cardiovascular disease.

While EPA has certified several disinfectants as effective against Covid-19 (List N), many of these chemicals are hazardous. These chemicals include QACs and other toxic compounds documented on Beyond Pesticides' list of "Disinfectants to Avoid." Although disinfection can kill pathogens, one must consider guidelines associated with proper selection and use of products. Conveniently, several safer disinfectants on EPA's list are effective against the virus, including citric acid, ethanol, isopropanol, L-lactic acid, hydrogen peroxide, sodium bisulfate, dodecylbenzene sulfonic acid, and thymol. These chemicals are present on Beyond Pesticides' "good" list of "Disinfectants to Look for," as natural-based substances tend to be safer while still effective at eliminating the virus on surfaces. Beyond Pesticides has said, "It is important during public health emergencies involving infectious diseases to scrutinize practices and products very carefully so that hazards presented by the crisis are not elevated because of the unnecessary threat introduced with toxic chemical use.... There is tremendous pressure to use toxic disinfectants, despite the availability of safer products. In fact, while [CDC] is recommending 70% alcohol for surface disinfection, [EPA's] Office of Pesticide Programs is advising the use of unnecessarily toxic substances, and reducing standards that govern their allowance on the market."

This study is the first to comprehensively assess the bioaccumulation of QACs in blood via biomonitoring, demonstrating a difference in chemical concentrations before and during the pandemic. The study notes that frequent detection of QACs in blood reveals widespread exposure among the general population. The major QAC groups include benzylalkyldimethylammonium compounds (BACs), dialkyldimethylammonium compounds (DDACs), and alkyltrimethylammonium compounds (ATMACs). The results show that, of the three groups, ATMACs are most abundant in blood samples. The authors conclude, "[T]he higher QAC concentrations in blood collected during the pandemic suggest increased exposure during this period, possibly due to the increased disinfection of the indoor and outdoor environment."

As the U.S. Covid-19 cases continue to rise, there is an urgent need to evaluate the effect pesticide exposure and uses have on health. Although some practices and products can prevent coronavirus infections, the continued use of toxic pesticides in the surrounding environment increases disease risk factors.

As the U.S. Covid-19 cases continue to rise, there is an urgent need to evaluate the effect pesticide exposure and uses have on health. Although some practices and products can prevent coronavirus infections, the continued use of toxic pesticides in the surrounding environment increases disease risk factors. When managing viral and bacterial infections, advocates say that we must not exacerbate the risk to animals and humans, while avoiding or controlling the threat. In the case of Covid-19, there exists measures of protection—both practices and products—that can prevent infection without using toxic products that increase risk factors. Advocates maintain that individuals and government officials alike should assess all risks associated with pesticide use, including the mode of action. However, EPA's failure to respond to current science is a significant shortcoming of its risk assessment process, especially regarding disease implications.

What to do: Individuals and government officials should observe all chemical ingredients on the disinfectant and sanitizer product labels and look at the use instructions to ensure that the method of use is safe for you. Beyond Pesticides tracks the most recent health studies related to pesticide exposure through our Pesticide-Induced Diseases Database (PIDD). This database supports the clear need for strategic action to shift away from pesticide dependency. For more information on harms associated with pesticide exposure, see PIDD pages on asthma/respiratory effects and other diseases. Additionally, learn how to protect yourself from Covid-19 safely by visiting Beyond Pesticides' webpage on Disinfectants and Sanitizers for more information.

SOURCE: Zheng G, Webster TF, Salamova A. Quaternary Ammonium Compounds: Bioaccumulation Potentials in Humans and Levels in Blood before and during the Covid-19 Pandemic. Environ Sci Technol. 2021 Nov 2;55(21):14689-14698 doi: 10.1021/acs.

INSECT DECLINE | MAY 17, 2022

Study of Dramatic Flying Insect Declines Reinforces Earlier Findings

With public awareness of an ongoing 'insect apocalypse' growing, one of the first anecdotes people often note is how many fewer bugs are found splatted on their car windshield than in the past. In a recent survey, conservation groups in Britain are finding evidence of insect declines in exactly that place, providing scientific backing for these concerning suspicions. Between 2004 and 2021, 58.5% fewer flying insects were squashed onto car license plates. "The results from the Bugs Matter study should shock and concern us all," says Paul Hadaway, conservation director at Kent Wildlife Trust, which conducted the study alongside UK organization Buglife. "We are seeing declines in insects which reflect the enormous threats and loss of wildlife more broadly across the Country. These declines are happening at an alarming rate and without concerted action to address them we face a stark future. Insects and pollinators are fundamental to the health of our environment and rural economies."

The survey was conducted primarily through citizen science, utilizing the "Bugs Matter" mobile app, and a sampling grid, referred to as a 'splatometer' that is affixed to a car's license plate. Data was retrieved from trips taken by citizen scientists between June 1 and August 31 in 2004 and 2021. Locations and trip distance were written down in 2004, but automatically tracked via the app in 2021. Trip speed generally averaged under 30 miles per hour, and trip length ranged between an average of 16 to 36 miles.

Analysis of the survey results determined a splat rate of .238 insect splats per mile in 2004, but only .104 per mile in 2021. Within that period, the odds of taking a trip and seeing no insects squashed to one's license plate increased by 2.9 times. Differences were seen between different areas of the United Kingdom. Scotland witnessed the smallest decline, at 28%, which could be attributed to the region having more wild land and fewer farms and cities. England, on the other hand, saw the greatest decline, at 65%, while Wales recorded losses of 55%. (Data was not available for Northern Ireland).

These results line up with the latest data on the insect apocalypse from peer-reviewed scientific literature. Published in *Nature*, a recent study finds that in the context of climate change, low intensity agriculture and expansive natural habitats provide the best chance to reduce insect losses. The more wildland regions have surrounding their farmland, the better insects are expected to fare. The difference between the results observed in Scotland and England line up well with that modeling.

"This vital study suggests that the number of flying insects is declining by an average of 34% per decade, this is terrifying," said Matt Shardlow, CEO at Buglife. "We cannot put off action any longer, for the health and well-being of future generations this demands a political and a societal response, it is essential that we halt biodiversity decline—now!"

Research published in 2017 documented a major red flag for insect populations worldwide, finding that in German nature preserves, 75% of flying insect biomass had been lost. A systematic review of insect population decline studies subsequently published in 2019 determined that 41% of insect species worldwide are declining. Declines of butterflies, wild bumblebees, and honey bees are specifically linked to hazardous pesticide use in industrial agricultural systems.

Worldwide, roughly a quarter of the global insect population has been lost since 1990, according to research published in *Science*. This research finds worldwide trends in declines in terrestrial insect biomass to be nearly 1% each year (~9% each decade). As a 2019 review concluded, "We know enough to act now." Across the globe, data continues to line up with people's anecdotal experiences of seeing fewer and fewer insects as the years go by. Unless we act soon, ecological amnesia will set it, as subsequent generations will perceive the environment in which they were born as the norm.

Consider the decline of insects in the context of efforts to stop the deaths of eagles, falcons, condors, and other birds of prey in the 1960s from widespread DDT use. Field observations of broken eggs in Peregrine falcon nests in Britain in the late 1960s led to populations surveys. In the United States, most longstanding falcon nests were found deserted. Massive increases in pesticide use following World War II were suspected as the cause, and it was confirmed that as DDT bioconcentrated up the food chain, it would be contained in eggshells. DDT concentrations in eggshells correlated in lock step with the thinness of an eggshell, scientifically confirming the issue.

With pollinators and the wider insect world, we are at a similar moment. We know that industrial agriculture and its use of hazardous pesticides, particularly systemic insecticides like the neonicotinoid class, are harming insect life and biodiversity throughout the globe. Scientific data is now so sophisticated we can provide year-by-year and decade-by-decade models of insect declines both past and future.

It took 10 years after Rachel Carson wrote *Silent Spring* for DDT to be banned. Yet, it has taken decades for bird of prey populations to bounce back. On the east coast, local populations of Peregrine Falcons were extirpated, and needed to be reintroduced over subsequent decades. It was not until 1999 that populations recovered enough to remove the birds from the endangered species list. Bald eagles were only removed from endangered species status in 2007. It was in early May that wildlife officials and the Yurok Tribe were able to reintroduce California condors into Northern California.

How many readers have anecdotally noticed more birds of prey in their region, but fewer pollinators and other insects?

What to do: The lag time between precipitous declines and species recoveries are often decades-long affairs. As we cheer the return of birds of prey we must likewise lament the years lost without them unnecessarily and shortsightedly, and be cognizant of the ongoing harm chemical use is causing to animals that form the basis of all ecological food chains. The work to ensure future generations can experience a world where "the bees are coming back" must start now. For more information on ongoing insect declines, see Beyond Pesticides article "Tracking Biodiversity: Study Cites Insect Extinction and Ecological Collapse." See here for more resources to get engaged and collect crucial ecological information through citizen science projects.

SOURCE: Lawrence Ball , Robbie Still, Alison Riggs, Alana Skilbeck, Matt Shardlow, Andrew Whitehouse, and Paul Tinsley Marshall. BugsLife/Kent Wildlife Trust Technical Report. May 2022; BugsLife UK press release.

BIODIVERSITY COLLAPSE | DECEMBER 9, 2022

UN Again Calls for Action as Biodiversity Deterioration Worsens Worldwide

Representatives from more than 195 countries have descended on Montreal for the December 7 start of COP15—the United Nation's (UN's) Conference of the Parties to the Convention on Biological Diversity (CBD). The UN Development Programme sets out the context for this summit: "Despite ongoing efforts, biodiversity is deteriorating worldwide, and this decline is projected to worsen with business-as-usual. The loss of biodiversity comes at a great cost for human well-being and the global economy." Beyond Pesticides has documented many aspects of this decline in biodiversity, and the implications for ecosystem, human, and planetary health. In this COP15 context, the data points to the importance of broad adoption of organic regenerative/agroecological systems, which can very significantly address the interactive health, biodiversity, and climate crises.

Close on the heels of November's UN COP27 summit on climate, COP15 has commenced, with the goal of adopting a post-2020 Global Biodiversity Framework (CBF) to provide "a strategic vision and a global roadmap for the conservation, protection, restoration, and sustainable management of biodiversity and ecosystems for the next decade." The first such summit was called the Convention on Biological Diversity and was held in 1993. Out of it and subsequent meetings have come several international agreements—the 2003 Cartagena Protocol on Biosafety (focused on environmental protection from

potential risks of genetically modified organisms), and the 2014 Nagoya Protocol (aimed at sharing benefits of the use of genetic resources in equitable ways), as well as other actions related to environmental integrity, community rights, and rights of Indigenous Peoples.

Prior to that, in 2010 the conference adopted a Strategic Plan for Biodiversity —the Aichi Biodiversity Targets for the 2011–2020 period. According to the International Union for Conservation of Nature, "[a]t the global level none of the 20 Aichi Biodiversity Targets agreed by Parties to the CBD in 2010 [were] fully achieved."

Subsequently, CBD focus shifted to the development of the Post-2020 Global Biodiversity Framework via the current (through December 19) meetings in Montreal. NGOs, such as Friends of the Earth and the CBD Alliance—the latter a network of civil society organizations—are engaged in the COP15 process. The CBD Alliance has forwarded equity and transparency concerns about that process, as demonstrated in this letter, and has set out its long list of "ingredients" it wants included in a successful COP15 GBF.

Among those is a serious and ambitious focus on the role of agroecological approaches to agriculture (and forestry) operations around the world. Agroecology overlaps broadly with organic regenerative agricultural approaches—for which Beyond Pesticides advocates strongly, and which it has described and explained here, here, and here (at 46:55). Agroecological approaches are generally described as: holistic and diversified; integrating ecological principles into the design and management of food production systems; incorporating social justice and cultural concerns; and embracing of multiple kinds of outputs, as well as spatial and temporal diversification. In addition, they center the health of the soil, the organismic ecosystems beneath the soil surface, and the resultant ability to draw down and hold carbon.

Such approaches show up "on the ground" in multiple strategies, including crop rotation; no (or very limited) chemical inputs, such as synthetic pesticides and fertilizers; interplanting and succession planting; use of cover crops; no- or low-tillage (without use of herbicides); and no or few off-farm inputs (and in the former case, typically because crop production is supported by and integrated with maintaining some on-farm livestock). The UN Food and Agriculture Organization provides a primer on the elements of agroecology.

Many organic producers operate according to a majority of these principles, although U.S. organic standards (i.e., U.S. Department of Agriculture Certified Organic) do not mandate use of all the practices described above. Some consider organic farming practices to be roughly synonymous with agroecological practices, but agroecology, as it is practiced in some parts of the world, also attends to the health of forests and their management. (See an illustrative case study, of an agroecological farm in Ethiopia, in an *Organic Without Boundaries* blog entry.)

According to Beyond Pesticides Executive Director Jay Feldman, U.S. "organic" does not require and codify all of those agroecological features in its National Organic Standards (NOS). But the NOP (National Organic Program) "does have defined standards that are enforceable and subject to public review. Because issues of cost are not factored into producers' meeting OFPA [the *Organic Foods Production Act*] standards, and because scale is often based on inputs or practices that are not allowed in organic, the USDA National Organic Program has,

embedded in it, standards that are generally not friendly to industrial agriculture. At the same time, with agribusiness pushing for entry into the organic market, we are vigilant in Keeping Organic Strong." (For more on what is allowed and not allowed in organic production, see the National List of Allowed and Prohibited Substances.)

The global transition to these approaches to agricultural production is imperative. In addition to Beyond Pesticides' long-standing and ardent endorsement of the transition, The Rodale Institute has studied and advocated for organic systems for decades, and in 2016, the International Panel of Experts on Sustainable Food Systems (IPES) issued a report calling for a "paradigm shift from industrial agriculture to diversified agroecological systems."

In recent years, multiple national and international entities have encouraged the transformation of food and agriculture systems, including aspects of the European Union's Farm to Fork strategy, and the United Kingdom's (UK's) Royal Society for the Encouragement of Arts, Manufactures and Commerce's Food, Farming and Countryside Commission, which issued a 2019 report—*Our Future in the Land*—calling for radical transformation of the UK food and agricultural system to sustainable, agroecological farming by 2030.

Unlike other approaches to sustainable development, agroecology helps to deliver contextualized solutions to local problems. It is based on bottom-up and territorial processes.

In his introduction to Beyond Pesticides' 2022 Forum Series seminar, Tackling the Climate Emergency, Mr. Feldman said, "We [in the U.S.] don't have to be theoretical about this. We have organic systems in place, governed by a clear definition and requirements for compliance with standards. Under OFPA in the U.S. (and similar statutes worldwide), those selling products as organic are required to adhere to a legal definition of soil management practices, a list of allowed and prohibited substances, a certification and inspection system that establishes compliance with defined organic standards, and a participatory public decision-making process for continuous improvement. This approach, whether in agriculture or in our parks and playing fields, eliminates the reliance on fossil fuel-based toxic chemicals that release greenhouse gases. It also employs the ability of healthy soil, rich in biodiversity, to draw down atmospheric carbon."

Seminar speakers emphasized the need for, and evidence of the many benefits of, the critical transition to organic regenerative/agroecological agriculture for rescuing and sustaining biodiversity, health, and climate. One of the seminar presenters was Dr. Rachel Bezner Kerr, PhD, a professor and expert on sustainable African agriculture, and on climate change adaption, who is also participating in COP15 discussions. (See Dr. Kerr's presentation at Beyond Pesticides' climate seminar, beginning at 5:48.)

Dr. Kerr recently Tweeted: "Agroecology is key to ensuring the success of the Global Biodiversity Framework," and pointed to a recent study of agroecological practices in Ethiopia as demonstrative of their potential benefits. That research paper calls agroecology "key . . . [to] meeting significant increases in our [future] food needs . . . while ensuring no one is left behind. . . . [A]groecology can promote the transition towards social-ecological sustainability. Unlike other approaches to sustainable development, agroecology helps to deliver contextualized solutions to local problems. It is based on bottom-up and territorial processes, involving the co-creation of knowledge, and combining science with the traditional, practical, and local knowledge of producers. It is characterized by its participatory approach," and enhances farmers' income, achieves food security, and protects the environment.

A report by another agroecology expert, Faris Ahmed of Carleton University, has been core to the case, pressed by advocates at COP15, to recenter the role of agriculture in recovering and supporting biodiversity, and in the GBF. His report for Friends of the Earth, *Replanting Agricultural Biodiversity in the CBD*, maintains that "agriculture needs to be dealt with both as a destructive force, and [for] its ability to nurture and restore biodiversity. Today's industrially driven, large-scale agriculture and intensive livestock production is identified as the biggest driver of land use change, ecosystem exploitation and destruction, and a significant contributor to climate change. However, agriculture is also a solution: in contrast to industrial agriculture, peasant agriculture and food provision, practiced by the majority of the world's small-scale farmers, nurtures and safeguards agricultural biodiversity."

Beyond Pesticides concurs. We have recently underscored the benefits of organic practices for biodiversity, drought resilience, climate, farm operation economics, and soil health, and amplified our call for a rapid phase-out of the use of toxic, petrochemical pesticides within a decade—a critical component in progress toward restored biodiversity and health for ecosystems and humans.

What to do: Mr. Feldman adds, "The agroecology movement is critical. We need a big tent to bring communities together worldwide and eliminate petrochemical pesticides and fertilizers in a short timeframe. At the same time, we need strong domestic and international standards, and governmental systems—with legal requirements and enforcement—that move agriculture to sustainable, agroecological/organic regenerative practices that can restore biodiversity and, simultaneously, address the climate and health crises."

Source: Friends of the Earth International

GUT MICROBIOME | CHANGES IN BEE GUT MICROBIAL ABUNDANCE | FEBRUARY 16, 2022

Review Provides New Insight into How Pesticide Exposure Disrupts Bee Gut Microbiome

Pesticide exposure disturbs the gut microbiome of social bees, leading to a range of alterations that could affect fitness in the wild, finds a major literature review recently published by researchers at the University of Ottawa, Canada. With research on bee gut microbiomes still in its infancy, the review provides a centralized overview of data collected to date, and highlights areas for further research to fill in remaining knowledge gaps. "Social bees have gut microbiotas that contribute to their health, just like we (humans) do," said Michelle Hotchkiss, a PhD candidate in the Faculty of Science at the University of Ottawa. "Further research on the interactions between pesticides, bee gut microbiotas, and bee hosts will help us better understand how pesticides affect bee health and performance."

To conduct their review, scientists collected research relating to bee gut over the last 50 years. "The earliest studies we found were published in the 1970s and the most recent ones in 2020," said Dr. Hotchkiss. "We summarized what methods were used to collect data, including which bee hosts and pesticides were examined. To summarize how the abundances of core microbes changed after pesticide exposure, we looked at studies that used molecular methods to characterize changes in microbial abundances," she added. "Importantly, we determined which microbes are most commonly affected by pesticide exposure and how they are affected. For example, does abundance increase or decrease after exposure? To what extent?" said Dr. Hotchkiss.

Studies show that pesticide use can disturb and shift the abundance of certain microbes in the bee gut microbiome, but rarely are these microbes completely eliminated. In general, researchers found declines in Bifidobacteriales and Lactobacillus bacteria to be the most common shifts observed.

Pesticide induced disturbances primarily in one of two ways—either directly harming microbes, and indirectly harming the host (bee) health and subsequently shifting the microbiome. Researchers cite glyphosate as an example of a pesticide that directly harms the growth of certain gut microbes. Indirectly, researchers cite pesticides with the ability to impact the bee immune system. Further, studies highlight how pesticides changing the physical and chemical conditions of bee guts, making their gut environment less suitable to certain microbes. These two forms of disturbances can occur at the same time, resulting in a deleterious positive feedback cycle for host bees.

The literature review also found that, regarding the impacts of exposure, the duration of pesticide exposure is more important than the amount of pesticide to which a bee is exposed. Longer exposure times result in more significant disturbances, but

likely vary by pesticide mode of action.

The impacts of pesticide-induced disturbances can be extensive, and have the potential to cause adverse effects throughout a bee's entire life. While the review captures a range of impacts, the work also highlights how little data is available on these effects. Most studies are focused on the effects of insecticides, while research on herbicides and fungicides are few. And apart from one, the current data available do no delve far into how microbial shifts impact bee performance. For example, this 2016 study reveals a range of alterations to the honey bee microbiome after exposure to different pesticides, but can only speculate on the functional impact. However, researchers note this 2018 study, focused on the impacts of glyphosate on bee gut microbiota, does track and find performance declines correlated to herbicide-induced alterations to the bee microbiome.

The researchers conclude, as all scientists are wont to do, with a call for further investigation on the topic. "Social bees have gut microbiotas that contribute to their health, just like we (humans) do. Further research on the interactions between pesticides, bee gut microbiotas, and bee hosts will help us better understand how pesticides affect bee health and performance."

What to do: The emerging data make it clear that for both humans and pollinators, chemical impacts on the microbiome should be taken into account by pesticide regulators. Currently, no studies are required to be performed on the impact of pesticide exposure on the gut biome by the U.S. Environmental Protection Agency (EPA). Help us tell EPA to embrace cutting edge science in its pesticide reviews by taking action today.

SOURCE: Michelle Z Hotchkiss, Alexandre J Poulain, Jessica R K Forrest, Pesticide-induced disturbances of bee gut microbiotas, *FEMS Microbiology Reviews*, Volume 46, Issue 2, March 2022, fuab056, https://doi.org/10.1093/femsre/fuab056; uOttawa press release

GUT MICROBIOME | HONEY BEE SUSCEPTIBILITY TO PATHOGENS | NOVEMBER 1, 2022

Pesticide Mixtures Reduce Life Span of Honey Bees, Damage Gut Microbiome

Honeybees exposed to a combination of multiple pesticides suffer a reduced lifespan and experience adverse changes to their gut microbiome, increasing susceptibility to pathogens and disease. This finding comes from a study published in *Science of the Total Environment,* which examines the interactions between the insecticides flupyradifurone and sulfoxaflor and the fungicide azoxystrobin on honey bee health. Both insecticides studied are considered substitutes for notorious bee-killing neonicotinoid insecticides, which move through the vascular system of the plant and contaminates its pollen, nectar, and guttation droplets. As declines in pollinator and insect life continue throughout the world, it is critical not only to understand and restrict widely used chemicals like neonicotinoids, but also the deleterious substitutes the agrichemical industry has developed to replace them. As the present study

reveals, pesticide risk assessments do not adequately capture the range of harm that can result when pesticides are combined, necessitating a shift toward safer, alternative, and regenerative organic farming systems that do not use these dangerous chemicals.

To better understand the impacts of combined pesticide exposure on honey bees, researchers employ three colonies located in Germany's Martin Luther University that were inspected and free of mites and viruses. Technical grade versions of each pesticide were used, eliminating additional confounders that could occur in consumer use products that also include "inert" (nondisclosed) ingredients.

Bees were exposed to field relevant levels of each pesticide per U.S. Environmental Protection Agency (EPA) data, as well as combinations of pesticides (specifically: flupyradifurone plus azoxystrobin and sulfoxaflor plus azoxystrobin) through sugar water for a period of 10 days. A separate experiment on the honey bee gut microbiome was constructed using newly emerged bees, which were housed and reared separately, and then exposed to a similar pesticide treatment as the initial experiment. An unexposed control group of honey bees was included in each experiment. "Our approach was based on the realistic concentrations that might be found in pollen and nectar from plants that have been treated with the pesticides," says study coauthor Yahya Al Naggar, PhD, of Martin Luther University.

For the initial experiment on individual bees, those exposed to flupyradifurone fared the worst, experiencing significantly reduced survival (50% reduction). The addition of azoxystrobin did not significantly add to this effect. However, with sulfoxaflor, it did. Bees subjected to sulfoxaflor and azoxystrobin in combination experience significantly reduced survival when compared to a sole sulfoxaflor exposure.

While direct mortality is disturbing, the pesticide-induced alterations inflicted on the bees' guts are a more insidious problem. Impacts to the gut are not seen within the first five days after pesticide exposure, but significant shifts do occur between days five and 10. At this time, treatments of flupyradifurone alone and in combination with azoxystrobin, as well as treatments of sulfoxaflor alone and in combination with azoxystobin, show significantly increased abundance of *Serratia spp*. This rod-shaped bacteria can seriously harm honey bee fitness. "These bacteria are pathogenic and harmful to bees' health," said Dr. Al Naggar. "They can make it harder for the insects to fight off infection, leading to premature death."

The ability of insecticides alone and in combination to cause delayed gut dysbiosis in honey bees is not an effect that an EPA pesticide risk assessment would ever capture under current data requirements.

The ability of insecticides alone and in combination to cause delayed gut dysbiosis in honey bees is not an effect that an EPA pesticide risk assessment would ever capture under current data requirements. EPA requires very basic screening level tests initially, and more detailed tests only if these tests indicate a need. Yet in context, while any testing is better than none, many advocates question the value of EPA protocols when initial screening is so lackluster. Case in point, both flupyradifurone and sulfoxaflor have been marketed by the agrichemical industry as "safer for bees," despite having effectively the same mode of action as bee-killing neonicotinoids. Data since their EPA registration has backed up the concerns of pollinator advocates. In fact, EPA was sued over its approval of sulfloxaflor, and rather than accept the court's decision to vacate the chemical's registration, EPA went ahead and registered the chemical again. As a result, beekeepers and conservations groups are back in court yet again to stop this bee-killing decision. With flupyradifurone, this is now the second study showing that the chemical causes signficantly more harm to bees when used in combination with a fungicide. Per a 2019 study, combinations of flupyradifurone and the fungicide propiconazole resulted in 73% mortality and increased abnormal behavior among exposed bees. Despite these concerns EPA has facilitated the expanded use of the chemical.

What to do: The combined impacts of different pesticides and how they may adversely affect the gut microbiomes of the animals we rely on to pollinate our food is something EPA should be at the cutting edge of investigating. Yet, the agency has consistently refused to implement measures that would investigate, let alone address these risks. As a result, more and more advocates, communities, and states are taking action to protect their pollinator populations. While many are embracing organic land care and eliminating all toxic pesticides, many states have merely restricted the neonicotinoids, permitting use of flupyradifurone, sulfoxaflor, and other equally harmful substitutes to continue. We need a team of pollinator experts to continually review the science and advise EPA, as proposed in the original *Saving America's Pollinators Act* would accomplish. Help pass this law by taking action today and telling your member of Congress to join in as a cosponsor. For more information on the dangers pesticides pose to pollinators and what you can do, see Beyond Pesticides Bee Protective webpage.

SOURCE: Yahya Al Naggar, Bala Singavarapu, Robert J. Paxton, Tesfaye Wubet, Bees under interactive stressors: the novel insecticides flupyradifurone and sulfoxaflor along with the fungicide azoxystrobin disrupt the gut microbiota of honey bees and increase opportunistic bacterial pathogens, Science of The Total Environment, Volume 849, 2022, 157941, ISSN 0048-9697, https://doi.org/10.1016/j.scitotenv.2022.157941; Martin Luther University press release

BEE POLLINATION DISTURBED | NOVEMBER 15, 2022

Synthetic Fertilizers and Pesticides Make Plants Less Attractive to Bumblebees, Research Shows

Spraying a flowering plant with synthetic fertilizers makes it less attractive to bumblebees, according to research published this month in *PNAS Nexus*. "A big issue is thus—agrochemical application can distort floral cues and modify behaviour in pollinators like bees," said study author Ellard Hunting, PhD, of the University of Bristol, UK. The findings underscore the limited understanding that proponents of chemical agriculture have about the complex processes that food production relies on, reinforcing calls for a broad scale transition to regenerative, organic farming practices.

Scientists began with the knowledge that spray applications of various agrichemicals affect the visitation patterns of bumblebees and other pollinators through a range of different processes. Past research finds that notorious bee-killing neonicotinoid insecticides not only kill bees outright, but also result in a range of complex damage, including their ability to impede bees' olfactory senses and adversely affect their vision and flying ability. Other chemicals like glyphosate weaken bees' ability to distinguish between colors.

A growing area of research is investigating the ways in which pollinators use static electric fields surrounding flowers to find food sources. A 2013 study found that bumblebees use floral electrical fields to discriminate between potential food sources. Subsequent reporting shows that bees use "mechanosensory" hairs on their body to detect these fields, that find that other pollinators like the hoverfly also use these cues. Flowers produce these fields "from the negative bio-electric potential within the flower and positive charges in the atmosphere, including the electrosphere and positively charged insects such as bees," the study explains. Pollinators interacting with flowering plants can change a flower's electric field, as the plant responds by producing more sap, for instance.

Past research finds that notorious bee-killing neonicotinoid insecticides not only kill bees outright, but also result in a range of complex damage, including their ability to impede bees' olfactory senses and adversely affect their vision and flying ability.

The authors confirm that applications of synthetic fertilizers and the neonicotinoid insecticide imidacloprid to flowering plants both result in significantly reduced foraging by bumblebees. To make this determination, a series of experiments were conducted to rule out other factors. To test whether the fertilizer was adversely affecting visual cues,

researchers observed the reflectance spectra of spray applications with fertilizer, finding that they were no different than simple demineralized water. To rule out odor as a factor in their findings, bees were provided sugar solution with and without fertilizer, and found that the bees showed no preference for one or the other.

Then researchers began exploring the effect of agrichemicals on the electric fields flowers produce. Cut flowers (*Geranium pratense*) were sprayed with simple water, or water with fertilizer, both with the addition of positively charged colored particles in order to observe the electrostatic deposition of the colored particles. The colored particles show significant differences between the two applications. The experiment was then repeated with a rooted, still growing flowering plant (*Jacobaea vulgaris*), and this time researchers measured the electrical field around the flower. Scientists find that fertilizers increase the flower's electric field, which then slowly returns to its previous state.

Digging deeper into the issue, researchers focused on the bio-electric potential energy within a plant's stem. Plants are known to respond to environmental stressors like cutting/herbivory and chemicals by changing the water flow and ion transport within their stems, which can subsequently be measured and manipulated. Moreover, changes observed within the bio-electric potential of a plant's stem are directly proportional to a plant's floral electric field. To test this process, cut *Lavandula angustifolia* flowers were sprayed with either water or a water-synthetic fertilizer solution, and their stem potential changes were measured. While water results in a change in stem potential that lasts up to a minute, synthetic fertilizers change stem potential for 16 minutes, and the neonicotinoid imidacloprid show alterations that last for up to 25 minutes. These measurements align directly with observed declines in bumblebee foraging interest in flowers recently sprayed with the agrichemcials. The authors note, "Since many chemicals used in agriculture and horticulture carry an electric charge, the observed mechanism could potentially be relevant for a wide array of chemicals."

Changes observed within the bio-electric potential of a plant's stem are directly proportional to a plant's floral electric field.

To add additional weight to their findings, scientists conducted another experiment in which they artificially maintained flower stems with altered electrical signals mimicking the changes seen with a fertilizer or insecticide application. Manipulated flowers experience 62 bumblebee approaches, while unaltered control flowers see 47. However, out of these 62, only 35 bumblebees landed on the manipulated flowers, while control flowers received 43 landings. "This suggests altered floral E-fields affect bee foraging when approaching the flower, and that bumblebees can detect and discriminate small and dynamic alterations in the electric landscape induced by agrochemical deposition," the study explains. To provide further context, study coauthor Sam England, PhD adds, "It's much like motorboat noise that hinders the ability of fish to detect their predators, or artificial light at night that confuses moths; the fertilisers are a source of noise to bees trying to detect floral electrical cues."

These chemicals not only interrupt the daily foraging of pollinators, they may also represent a longer-term threat. In a final experiment, researchers replicate a rain event after an initial fertilizer treatment. Plants respond with a similarly prolonged alteration of their electrical signal. The authors note that fertilizer applications may thus chronically reduce pollinator foraging either by recurring electric alterations after a rain event or from learned negative associations with the altered plant.

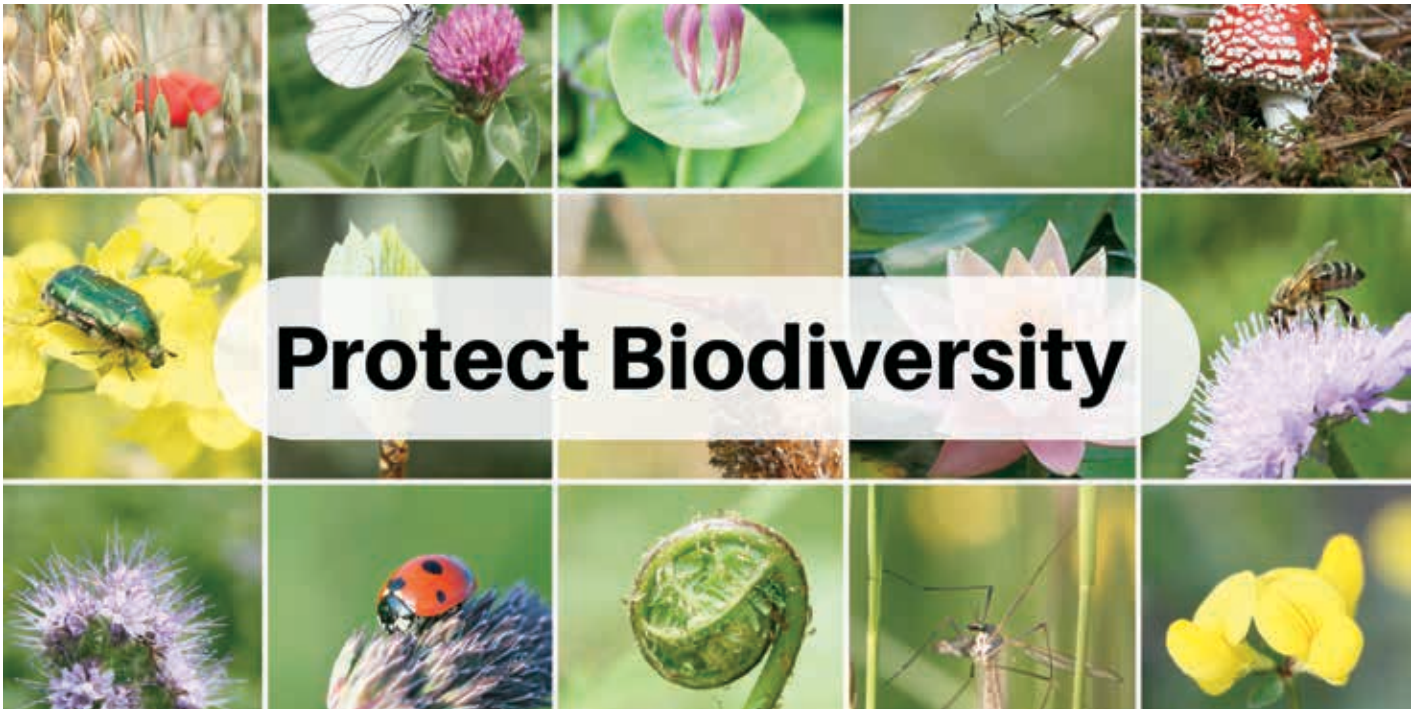
"The fact that fertilisers affect pollinator behavior by interfering with the way an organism perceives its physical environment offers a new perspective on how human-made chemicals disturb the natural environment," Dr. Hunting notes.

These results fly in the face of outdated toxicological approaches that agrichemical companies hide behind when confronted with the on the ground impacts of their dangerous products, such as 15th century Paracelsian concept that "dose makes the poison." As modern science delves deeper into the inner working of plants and insects and the interactions between these critically important groups, it finds the world to be incredibly more complex than an inaccurate adage.

Solutions to the problems of chemical-intensive agriculture exist and provide proof of concept that farming can occur without a range of negative impacts on the surrounding environment. Organic agriculture has never permitted the use of synthetic fertilizers, nor do organic farmers ever use synthetic insecticides like the bee-killing neonicotinoid imidacloprid. Instead, regenerative organic farming embraces a natural systems approach, taking efforts to work with and enhance the existing ecological services in their region.

What to do: Organic farming yields multiple bottom line benefits for wildlife and the wider environment, human health, and the economy. For more information on the dangers of synthetic fertilizers and alternative, organic companies you can support, see Beyond Pesticides page on Fertilizers Compatible with Organic Landscape Management. Eliminate synthetic fertilizers and toxic pesticides in your town by sending a letter to your local officials today.

SOURCE: Ellard R Hunting, Sam J England, Kuang Koh, Dave A Lawson, Nadja R Brun, Daniel Robert, Synthetic fertilizers alter floral biophysical cues and bumblebee foraging behavior, *PNAS Nexus*, Volume 1, Issue 5, November 2022, pgac230, https://doi.org/10.1093/pnasnexus/pgac230; University of Bristol press release



INTERNATIONAL SCIENCE-POLICY PLATFORM WARNING | JULY 15, 2022

UN: Short-Term Economic Gains Harming Well-Being and Integrity of Nature

Nature is too often sacrificed to a global and outsized focus on short-term profits and economic growth, according to a new report by the United Nations Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The report warns that policymaking, broadly, does not reflect the value of Nature's roles in supporting human life and activity, never mind all the peripheral benefits (aesthetic, emotional, spiritual) people derive from the natural world. The report calls on leaders in all sectors to integrate the contributions of Nature in development and deployment of policy in a more comprehensive way—as *Le Monde* writes, "beyond being 'a huge factory.'" Beyond Pesticides offers a seminal reminder from Fred Kirschenmann, PhD: the prevailing philosophy of maximum efficient production for short-term economic return at the expense of Nature causes havoc in the world and will not work in the future; instead, we must develop a broad ecological conscience that guides all that we do.

The report's Summary for Policymakers was approved on July 11 by representatives from 139 Member States; the report itself is the culmination of four years of effort by 82 collaborating scientists and experts from multiple disciplines. The same member representative approved an additional IPBES report that urges the member governments to sustainably manage the wild plant and animal species on which the world's populations depend for their survival.

IPBES cochairs Patricia Balvanera, Brigitte Baptiste, Mike Christie, and Unai Pascual noted, according to the UN's press release, that examples of "embedd[ing] [N]ature into policymaking are 'in short supply.'" The press release asserts that, although "economic and political decisions have predominantly prioritized market-based values of nature . . . they do not adequately reflect how changes in the natural world affect people's quality of life."

As *Le Monde* reports, for example, re: the biodiversity crisis: "According to IPBES, the value that is predominantly attributed to biodiversity, its market value, does not reflect the value of its contribution to humanity. And furthermore, doing so does not allow us to face the huge challenge of the loss of biodiversity. With their limited vision of what nature gives us, the political and economic decisions being made today are, on the contrary, 'a key factor' in the origin of the crisis." An IPBES webpage leads with this headline about the values assessment: "Decisions Based on Narrow Set of Market Values of Nature Underpin the Global Biodiversity Crisis."

Looking to history to explain some of this situation, we find that a combination of factors is likely at work, not least of which is the Industrial Revolution and its massive impacts—made possible by the extraction and burning of (finite) fossil fuels. Reaching farther back in time, we recall the Enlightenment (and biblical) notions that humans are

somehow separate from, and destined to dominate and subdue, Nature. Dr. Kirschenmann argues that these led to people focusing dominantly on humans and their enterprises, and—detrimentally—less and less during the past half millennium on the natural world and its welfare.

From that paradigm—and fertilized by cheap energy, the rising power of corporations during the past 100 years, and their influence on government—have flowed particular approaches to human activity, including specialization, a focus on productivity, and the neurochemical and economic "feel-goods" of short-term profit. Those approaches are easily recognized in what they have wrought—most of the woes and crises of modernity, including:

- galloping climate change
- chemical saturation of humans, other organisms, and the natural world
- depleted resources (which were always finite, but which human hubris has often chosen to ignore)
- massive economic inequality
- increasing "brittleness" in systems' ability to be resilient to a variety of assaults
- emerging civil and economic tensions and crises (historically followed by civil unrest)
- the rise of oligarchic and authoritarian figures in the political landscape

The UN IPBES report is an attempt to call humanity's, and pointedly, global leaders', attention to these matters, and to advocate for the integration of valuations of Nature into decision making. The authors began with a deep dive on valuations of Nature. The Summary for Policymakers identifies four "values-based leverage points"—undertaking valuation, embedding values in decision making, policy reform, and shifting societal goals—that coauthors say may catalyze a transformation to a sustainable and just future.

The more-academic work on the valuations of nature that informed the IPBES report (available in the "Contrasting Approaches to Values and Valuation" document) asserts that the current discursive paradigm tends to emphasize the split between anthropocentric (instrumental) and non-anthropocentric (intrinsic) aspects of Nature. Largely, people cleave to one or the other of those frameworks in their thinking. The authors write, "[M]uch of the policy discourse on the need for valuation of nature's contributions to people heavily relies on either a one-dimensional value lens (value-monism) that derives from a utilitarian economic perspective or on an environmental ethics stance of nature-human relationships, furthering the instrumental vs. intrinsic dichotomy."

Instead, they argue, what's needed in human thinking, and in policymaking, is "value pluralism"—a more dynamic and relational understanding of Nature's values, i.e., one that emphasizes the value of the interactions between people and nature, and those among individuals in society. IPBES cochair Mike Christie explains the focus on values assessment by saying that "'valuation is an explicit and intentional process" that hinges on "how, why and by whom" the valuation is "designed and applied.'" Cochair Brigitte Baptiste added that "recognizing and respecting the worldviews, values, and traditional knowledge of indigenous peoples and local communities allows policies to be more inclusive, which also translates into better outcomes for people and nature."

The press release proffers that "'Living from, with, in, and as nature' means providing resources that sustain people's livelihoods, needs and wants, including food and material goods. . . . It also focuses on non-human life, such as the intrinsic rights of fish in a river to 'thrive independently of human needs,' and sees the natural world as a 'physical, mental and spiritual part of oneself.'"

Beyond Pesticides has written about the value of Nature's ecosystem services and threats to them, including the fragility of ecosystems to chemical assaults. It has covered the biodiversity and climate crises, and the outsize corporate and industry influence on policy at EPA and other federal agencies. It has written about a precautionary approach that would go far in addressing the environmental crises that seriously threaten not only human health, but all life on Earth. And it has researched, written about, and advocated endlessly for the huge role that the transition to organic regenerative agriculture would play in resolution of multiple of the threats humanity faces.

From that paradigm—and fertilized by cheap energy, the rising power of corporations during the past 100 years, and their influence on government—have flowed particular approaches to human activity, including specialization, a focus on productivity, and the neurochemical and economic "feel-goods" of short-term profit.

What every one of those arenas has in common is what this IPBES report identifies: governmental, corporate, and institutional prioritizing of short-term economic gains over the well-being and integrity of Nature and its elegant, complex, and life-sustaining systems. Drawing again from Dr. Kirschenmann in his 2015 article in *Pesticides and You*, he continues:

"This is what we have to do now. It's not enough any longer for us simply to care about our fellow humans. We have to care for all of the life in the biotic community of which, as Aldo Leopold said, we are simply plain members and citizens. [Beyond Pesticides adds that this means all of Nature, including non-biotic elements.) We are not the dominators. We are not the culture. We are not the conquerors. . . . So, we have to find our place in [Nature], because if it is not all healthy and if it doesn't all have the capacity for self-renewal, then none of it will include us."

"This is the new consciousness that we have to develop. Leopold

recognized . . . that was a huge challenge. . . . He understood there wasn't much that he could do as an individual to make this happen. He finally concluded that this had to become part of a social evolution."

What to do: This UN report is testament to the need for, and a call to enact, such evolution with all speed. Yet, this is a huge lift, and Beyond Pesticides is but one actor in a huge landscape of people and organizations clamoring for changes in "business as usual," which are at the root of our multiple crises. Please—please—become engaged with Beyond Pesticides or with any other environmental, health, civic, and/or justice organization that recognizes the dangerous follies of our current approaches to policy making. Bringing to policy an ethic of "value pluralism" that integrates the importance of Nature and its integrity is not only critical, but also, one path forward to a functional, equitable, livable future.

SOURCE: UN Report: Value of nature must not be overridden by pursuit of short-term profit

ECOSYSTEM SERVICES INCREASE CROP YIELD | APRIL 13, 2022

Ecosystem Services Provided by Birds and Bees Synergize To Increase Farm Yield and Profit

The combined effects of insect pollination and natural pest control provided by birds synergize to improve yields and income for coffee farmers, finds research published this month in the journal PNAS. Ecosystem services—the positive benefits provided by ecosystems, wildlife, and their natural processes – underpin agricultural production, but are often analyzed in silos, on a case-by-case basis in the scientific literature. The current research finds that the quantitative benefits of ecosystem services can be greater when considering their interactive effects.

"Until now, researchers have typically calculated the benefits of nature separately, and then simply added them up," says lead author Alejandra Martínez-Salinas, PhD of Costa Rica's Tropical Agricultural Research and Higher Education Center (CATIE). "But nature is an interacting system, full of important synergies and trade-offs. We show the ecological and economic importance of these interactions, in one of the first experiments at realistic scales in actual farms."

Researchers base their experiment in Costa Rica, working with 30 shade grown coffee farms owned by small landholders. Eight coffee plants on each farm were selected for the study. Pest control services provided by birds are assessed using a 20mm mesh screen that excludes birds but allows bees and other insect pollinators to forage. Bee pollination is analyzed by choosing four comparable branches on each of the eight coffee plants and using nylon mesh bags to exclude bees during flowering on two of the four branches. With this design, scientists are able to evaluate bird activity alone, pollination activity alone, bird and bee activity

combined, and no activity from either birds or bees.

The impacts of these services are evaluated on the fruit set, fruit weight, and economic value of a coffee farm's output. With each of these measurements, ecosynergy, a synergy between ecological services, results in the greatest benefit. While bird activity alone does not increase fruit set or weight, bee activity alone does cause a modest average increase of 11% in fruit set and 4.2% in fruit weight. Combined activity of birds and bees show the highest fruit set and weight among all scenarios, with a 24% increase in fruit set and 6.6% increase in fruit weight.

Increases in fruit weight and set means greater economic benefits for coffee farms. Researchers estimate that farmers generally receive roughly $4,300 US dollars per hectare. The results of the experiment show that excluding birds reduces yield by 13.5%, representing a nearly $600 loss per hectare. Losing bees in the landscape reduces yield by 24.5%, a $1,059 per hectare loss. Losing both birds and bees causes the highest yield and economic loss at 24.7%, representing a $1,066 gap.

"These results suggest that past assessments of individual ecological services—including major global efforts like IPBES—may actually underestimate the benefits biodiversity provides to agriculture and human wellbeing," says Taylor Ricketts, PhD, of the University of Vermont. "These positive interactions mean ecosystem services are more valuable together than separately."

The study underscores the importance of preserving, maintaining, and improving on-farm biodiversity and ecosystem services as a key aspect in considering agricultural yields. These services are critical, yet more vulnerable than one may think. For instance, research published in 2015 by some of the same scientists from the current study found that only a small number of bee species actually provide pollination services, making their continued existence crucial to long-term farm sustainability and profitability. A study published in 2016 found that the loss of microbial diversity in the soil hampers ecosystem services associated with decomposition, nutrient cycling, and carbon fixing, all critical roles needed to maintain food production.

The 2019 report from the United Nation's IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) provides a stark warning to the world about the how the decline of biodiversity impinges on society's ability to meet basic needs. But as the authors of the present study note, even these dire calls may underestimate the benefits humanity is provided by natural services, those which are often taken for granted.

Time and again, research has found that increasing on-farm biodiversity decreases the need for pesticide use (by increasing natural pest management services), and improves overall productivity. That is why organic farming represents the best approach for the future of farming. A core component of organic law is the requirement to maintain or improve soil health. From this concept flows the spirit and intent of organic to continuously improve, and promote natural materials and processes over synthetic substances. These practices on the ground, according to Rodale Institute's long running Farming Systems Trial, result in higher organic matter and improved soil health, yields that are competitive with chemical-intensive practices, farm profits 3-6 times higher, and significantly less greenhouse gas emissions and chemical use.

What to do: The benefits of natural systems are difficult to suss out without considerably more investment in the sort of research being conducted in the present study. As the author's note, the available literature on synergies between ecosystem services is particularly thin, and in need of further time and attention. For a review of the importance of biodiversity and ecosystem services to food production and our current way of life, see the articles "Organic Systems The Path Forward," and "Biodiversity in Land Management Integral to Sustainability," published in the *Pesticides and You* journal. In the meantime, it is critical to support organic.

SOURCE: Alejandra Martínez-Salinas, Adina Chain-Guadarrama, Natalia Aristizábal, Taylor H. Ricketts. 2022. Interacting pest control and pollination services in coffee systems. PNAS, 119 (15) e2119959119. https://doi.org/10.1073/pnas.2119959119; University of Vermont press release

BENEFITS OF NATURE | SEPTEMBER 9, 2022

Seeing the Value of Nature through Beavers, as Cattle Ranchers Benefit from These "Ecosystem Engineers"

One kind of solution to the biodiversity crisis that is likely not on most folk's bingo cards comes from a Nevada cattle rancher, who has shifted his relationship with . . . wait for it . . . beavers. As climate change impacts ramp up their toll in the U.S. via intensified droughts, floods, and wildfires, solutions are widely and eagerly sought, if deployed at insufficient pace. In this Nevada case, Agee Smith—unlike his rancher father, who reportedly "waged war against the animals, frequently with dynamite"—welcomes beavers and their industry on his ranch land. Doing so has yielded multiple benefits for his operation, the environment, and biodiversity. As reported by *The New York Times (NYT)*,

"Mr. Smith has become one of a growing number of ranchers, scientists and other "beaver believers" who see the creatures not only as helpers, but as furry weapons of climate resilience."

Many landowners, of all stripes, consider beavers to be destructive "nuisance" animals that wantonly fell trees, and in so doing sometimes flood farm fields, back yards, roads, forests, or grazing acreage. Public complaints about such behaviors resulted in the federal government's killing of more than 25,000 beavers in 2021. Such "reduction" is conducted by the Wildlife Services division of the U.S. Department of Agriculture (USDA); the program targets some invasive species that are deemed to threaten ecosystems (e.g., feral hogs or the giant nutria, a swamp rodent). It also kills huge numbers of native species, such as beavers, coyotes, Canada geese, red-winged blackbirds, wolves, black bears, bobcats, foxes, deer, prairie dogs, and others.

In 2021, more than 400,000 native animals were decimated. *The Guardian* reports that in 2021, 1.75 million total animals were killed—an astonishing metric, but lower than in some years; in 2010 the figure was roughly five million; in 2018, the number was northward of 2.5 million. Among the techniques employed is use of noxious M-44 cyanide "bombs," which have resulted in the death of a child, the blinding of another, and deaths of non-target species, such as dogs, opossums, raccoons, a wolf, ravens, and skunks.

When peaceful coexistence just does not work out, advocates encourage relocation of the animals, rather than their destruction.

According to *The NYT*, experts say that when human–beaver conflict does arise, as it will inevitably sometimes, there are non-lethal solutions. For example, fencing and paint can protect specific trees from powerful beaver incisors. There are also devices that stealthily undo the creatures' handiwork via pipes that drain water from beaver settlements—even while the animals keep building. Wildlife advocates say that such tactics are actually highly effective, compared to killing the animals, because new beavers are likely to move into existing and desirable beaver habitat that has been vacated. When peaceful coexistence just does not work out, advocates encourage relocation of the animals, rather than their destruction.

Mr. Smith and some other landowners are seeing real benefits of their welcoming beavers on their land—many related to greater resilience to climate change impacts. The *NYT* reports on Mr. Smith's experience: "When Nevada suffered one of the worst droughts on record, beaver pools kept his cattle with enough water. When rains came strangely hard and fast, the vast network of dams slowed a torrent of water raging down the mountain, protecting his hay crop. And with the beavers' help, creeks have widened into wetlands that run through the sagebrush desert, cleaning water, birthing new meadows and creating a buffer against wildfires."

Beaver dams—constructed to create safe impoundment areas for their lodges—help store water (a real livestock and wildlife "lifesaver" during now-frequent droughts in the West), slow down its flow during heavy rains or rapid snowmelt, reduce erosion from torrential downpours, and help recharge

groundwater. The persistent wetlands beavers sometimes create also store carbon, thus, keeping it out of the atmosphere. In addition, beaver activity keeps the surrounding landscape damper, reducing the risk of wildfire. And the cherry on the whipped cream on the sundae is that the beavers' work helps create new or restored habitat for myriad species, including fish, mammals, waterfowl, birds, amphibians, and insects. Plusses for the climate? Check. For biodiversity? Check. For Mr. Smith's hay and cattle? Check. We believe this is called a "win-win-win."

Not for nothing are these creatures considered by some to be consummate ecosystem/environmental engineers. Chris Jordan, PhD, of the National Oceanic and Atmospheric Administration Fisheries, and Emily Fairfax, PhD, of California State University Channel Islands wrote in early 2022: "It may seem trite to say that beavers are a key part of a national climate action plan, but the reality is that they are a force of 15–40 million highly skilled environmental engineers. . . . We cannot afford to work against them any longer. We need to work with them." California's Secretary of Natural Resources Wade Crowfoot sums up the sentiment: "We need to get beavers back to work. Full employment for beavers!" Beaver believer Agee Smith notes that welcoming beavers to work on his land has been one of his best decisions, adding, "They're very controversial still. But it's getting better. People are starting to wake up."

The Orianne Society, which advocates for the conservation of reptiles and amphibians and their ecosystems, describes "ecosystem engineers" well: "Ecosystem engineers are species that modify their environment in a significant manner, creating new habitats or modifying existing ones to suit their needs. Through their activities ecosystem engineers significantly affect other species by providing and maintaining microhabitats that would not otherwise exist. In fact, ecosystem engineers can often (but not always) be defined as keystone species, meaning that they play a critical role in their environments and affect many other species in the ecosystem. Ecosystem function and biodiversity would be significantly reduced without the presence of a keystone species. . . . The beaver is probably the most well-known example of a typical ecosystem engineer that also acts as a keystone species. Beavers cut down trees and build dams in small waterways, backing up water and creating beaver ponds. Beavers manipulate waterways for their own benefit, but these manipulations also provide habitat for many other species. Beaver dams and ponds also play important roles in many abiotic ecosystem processes (e.g., nutrient cycling and siltation). Without beavers to modify existing environments, these important wetlands would not exist and many species would be negatively affected."

The federal Bureau of Land Management (BLM) sees merit in the efforts to "employ" beavers to benefit the creatures themselves, as well as ecosystems and human interests.

However, river scientist Caroline Nash, PhD, who has done research on beaver-related restoration, emphasizes that human cooperation with the engineering activities of beavers should be deployed after case-by-case evaluation, asserting, "It's all about identifying those locations where beavers' survival interests align with humans' survival interests, and they're not always aligned. . . . [S]o suggesting that they're always going to be aligned is creating a recipe, I think, for broken hopes and expectations and a loss of trust."

The federal Bureau of Land Management (BLM) sees merit in the efforts to "employ" beavers to benefit the creatures themselves, as well as ecosystems and human interests. It is working with partners in Oregon, Wyoming, Utah, Montana, Nevada, Idaho, and Colorado to "seed" beaver-like dams that, it is hoped, beavers will inhabit and expand. California's state budget has earmarked roughly $1.5 million annually for restoration of beavers—for their roles in advancing climate resiliency and biodiversity.

As such efforts reference, the biodiversity crisis travels hand in hand with the climate crisis; the causes and solutions are necessarily interactive. And as noted in an article in the European Commission magazine, *Horizon*, "Climate change and biodiversity loss should be tackled together": "In a two-way process, climate change is one of the main drivers of biodiversity loss, but destruction of ecosystems undermines nature's ability to regulate greenhouse gas (GHG) emissions and protect against extreme weather, thus accelerating climate change and increasing vulnerability to it. This explains why the two crises must be tackled together with holistic policies that address both issues simultaneously and not in silos."

The chief causes of the significant global loss of biodiverse organisms are generally acknowledged to be changes in land use (largely for large-scale food production, such as the clearing of Amazonian rainforest land for cattle grazing); overexploitation of organisms for food, wood, and medicines (via hunting, fishing, and harvesting beyond sustainable boundaries); climate change; and chemical overuse (in nearly every sector of human activity, and pointedly, in agriculture) that harms organisms and their ecosystems.

[A brief sidebar on cattle: environment and food system advocates, including the World Wildlife Fund, have pointed repeatedly to the devastation caused by cattle ranching in the Amazon region, where 80% of the deforestation of the "lungs of the world" is caused by the beef cattle sector. Though this is by far the most dramatic example of the unsustainability of this livestock practice, the huge land area and water resources devoted to raising beef cattle in the U.S.—never mind the problematic waste and methane production associated with the CAFOS

(concentrated animal feeding operations) on which most domestic livestock is raised—warrant a serious reconsideration of the role of this industry's commodity in the American diet.]

By their very nature, pesticides are designed to reduce biodiversity—to suppress any population seen as a threat to economic enterprise, human health, and/or human convenience. Beyond Pesticides laid out the case, a few years ago, for how pesticide use is ravaging, especially, insects (including many critical pollinators) and soil microorganisms, and their ecosystems and food sources, and how organic agriculture supports biodiversity.

By their very nature, pesticides are designed to reduce biodiversity—to suppress any population seen as a threat to economic enterprise, human health, and/or human convenience.

Indeed, the 2019 United Nation's (UN's) Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) report said that the species extinction rate is accelerating and that Nature, broadly, is declining at a rate "unprecedented in human history." The subheads of the comprehensive report are telling: "Current global response insufficient; 'Transformative changes' needed to restore and protect nature; Opposition from vested interests can be overcome for public good; [and] 1,000,000 species threatened with extinction."

IPBES Chair, Sir Robert Watson, commented at the report's release: "The health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide. . . . The report also tells us that it is not too late to make a difference, but only if we start now at every level from local to global."

There are efforts—in addition to rancher peacemaking with beavers—to restore diverse populations and habitats. In 2021, U.S. House Representatives Joe Neguse, Alan Lowenthal, and Jared Huffman reintroduced a resolution calling for a national biodiversity strategy. Rep. Lowenthal commented, "It is imperative that we work to correct this immediately — not only to protect the world's disappearing biodiversity but because the impacts to our environment and climate also impact our economies, human health, and our ability to live on this planet."

In June 2022, the U.S. House passed the *Recovering America's Wildlife Act* (RAWA), which would invest $1.397 billion per year in state, local and tribal efforts to help wildlife at risk. The Nature Conservancy (TNC) endorses this legislation, which is now in the hands of the Senate, saying that RAWA would "invest in time-tested, locally driven strategies to restore species and the ecosystems that sustain them." In addition, there is, according to TNC, much discussion of pairing this bill with one that would end the abuse of conservation easements for tax shelter purposes [—a favorite ploy of very wealthy landowners, including large corporations]. The bipartisan *Charitable Conservation Easement Program Integrity Act* would put a stop to these fraudulent actions and, in doing so, cover most of the cost of RAWA."

Early in President Biden's term, the administration announced a U.S. Interior Department initiative, 30 by 30, that joins the U.S. with 50 other countries in aiming to conserve 30% of each nation's land and water by 2030. A laudable goal, but the announcement of 30 by 30 underscores an inexplicable fact: the U.S. is the only United Nations (UN) member that has not ratified what is arguably the most important international treaty on biodiversity—the *UN Convention on Biological Diversity*. (See a list of signatories, as well as of those countries that have ratified the treaty, here.)

As reported by *Vox*, the U.S. helped craft the treaty, and signed on to it in 1993, but for nearly three decades, "Republican lawmakers have blocked ratification, which requires a two-thirds Senate majority. They've argued that CBD would infringe on American sovereignty, put commercial interests at risk, and impose a financial burden, claims that environmental experts say have no support." Environmental advocates assert that the U.S. refusal to ratify the treaty causes real harm to biodiversity efforts when, never more than now, the crisis makes them imperative.

What to do: The need for action on protecting Nature's creatures and habitats could not be more urgent. The International Union for the Conservation of Nature (IUCN) quotes UN Secretary-General Antonio Guterres's pithy assessment: "*Making peace with nature is the defining task of the 21st century, it must be the top, top priority for everyone, everywhere.*"

Beyond Pesticides continues to do its part in bringing this issue forward, including through the second session of the 2022 National Forum Series: Meeting the Health, Biodiversity, and Climate Crises with a Path for a Livable Future. The plenary sessions for that day focus on various topics on the biodiversity crisis and solutions. We call attention particularly to the presentation of Lucas Garibaldi, PhD, who is a member of IPBES and contributed to its most recent report. He is also co-chair the Transformative Change Assessment for the Convention on Biological Diversity (CBD); the group is tasked with identifying options for achieving the CBD 2050 vision for biodiversity. Please watch this important series on addressing the related and growing biodiversity, climate, and health crises.

SOURCE: Einhorn, Catrin. 2022. It Was War. Then, a Rancher's Truce With Some Pesky Beavers Paid Off. *The New York Times*. 2022

INERT INGREDIENTS HARM POLLINATORS | APRIL 21, 2022

Literature Review Adds to the Growing Evidence that Inert Ingredients Are Toxic to Pollinators

A literature review published in Royal Society finds that 'inert' ingredients' in pesticide formulations adversely affect the health of bees and other wild pollinators. Inert ingredients, also known as "other" ingredients, and not disclosed by name on pesticide product labels, facilitate the action of active ingredients targeting a specific pest. Although both ingredients have chemical and biological activity, most studies on agricultural chemical toxicity focus on the active ingredient, assuming that inert ingredients are "nontoxic." The U.S. Environmental Protection Agency (EPA), in regulating pesticides, assesses the toxicity of individual active ingredients on bees through various testing methods. However, there are no requirements for EPA to test inert ingredients to the same degree, despite evidence demonstrating these chemicals harm pollinators. Moreover, EPA does not require pesticide manufacturers to disclose to the public the inert ingredients used in any product as the information is considered proprietary.

Both wild and commercial bees and other pollinators encounter multiple stressors, including pesticides, parasites, and poor nutrition, that act together to increase the risk of bee mortality. Therefore, reviews like these highlight the need for pesticide testing to consider the effects of all product ingredients, regardless of perceived toxicity. The researchers caution, "We argue that 'inert' ingredients have distinct, and poorly understood, ecological persistency profiles and toxicities, making research into their individual effects necessary. We highlight the lack of mitigation in place to protect bees from 'inert' ingredients and argue that research efforts should be redistributed to address the knowledge gap identified here. If so-called 'inert' ingredients are, in fact, detrimental to bee health, their potential role in widespread bee declines needs urgent assessment."

In conducting a systemic literature review of studies regarding the effects of inert ingredients on bee health, researchers find no empirical evidence that inert ingredients are nontoxic, despite that often being the assumption. There are only 19 studies that test the effects of inert ingredients on bee health. The results demonstrate that multiple exposure routes act in conjunction and synergistically with other stressors (e.g., disease, climate, habitat destruction, etc.) to cause bee mortality with colony-level consequences.

The United Nations states that 75 percent of the 115 top global food crops depend on insect pollination, with one-third of all U.S. crops depending on pollinators, according to the U.S. Department of Agriculture (USDA). However, research finds that many insect populations are declining, including managed and wild pollinators, mainly due to habitat fragmentation, climate change, and extensive pesticide use. There are

various classes of bee-toxic pesticides, such as neonicotinoids, sulfoxaflor, pyrethroids, fipronil, and organophosphates. Research shows that residues from neonicotinoids (including seed treatments) and sulfoxaflor accumulate and translocate to pollen and nectar of treated plants, increasing the potential risk and indiscriminate poisoning to pollinators. Both pyrethroids and fipronil impair bee learning, development, and behavioral function, reducing survivability and colony fitness. However, inert ingredients in these products cause similar or more severe impacts on bee populations, such as disruption in bee learning behavior through exposure to low doses of surfactants. With the global reliance on pollinator-dependent crops increasing over the past decades, a lack of pollinators threatens food security and stability for current and future generations.

The study finds only 19 studies investigate the effects that inert ingredients have on pollinator health, despite the fact that inerts typically make up most of the ingredients in pesticide formulations, up to 99 percent in some cases. Although manufacturers claim inert ingredients, including surfactants, emulsifiers, and other co-formulants, do not harm target pests like active ingredients, inerts can be even more toxic than active ingredients, as these chemicals magnify the effects of active ingredients, sometimes as much as 1,000-fold. Moreover, inert ingredient exposure can occur through many routes, impacting both target and nontarget species. One of the most hazardous ingredients in the commonly used herbicide Roundup, polyoxyethylene tallow amine (POEA), is a surfactant classified as an inert and therefore not listed on the product label. However, researchers find that POEA can kill human cells, particularly embryonic, placental, and umbilical cord cells. Therefore, it is essential for agencies to require manufacturers to disclose inert ingredients to limit adverse health effects in the ecosystem, especially among nontarget species.

This is not the first research to cite inert ingredients as dangerous to pollinators. Inert ingredients in pesticide mixtures, like N-methyl-2-pyrrolidone and Slygard 309 (surfactant), increase baby bee mortality and honey bee susceptibility to deadly viruses. The latest concerning news on inert ingredients revolves around widespread findings that PFAS chemicals contaminate pesticide products. A 2017 study detected PFAS chemicals in bee hives, with another study indicating PFOS (a certain type of PFAS chemical) can increase honey bee mortality and halt brood development.

Although evidence suggests inert ingredients are the primary culprit of pollinator decline, scientists maintain that agency assessments should not disregard the impacts that active ingredients have on pollinator health. A 2018 study found that technical grade (pure) glyphosate disrupts honey bee microbiota, with sublethal effects on honey bee navigation and foraging success. Moreover, science accumulated over the last decade and a half demonstrates that neonicotinoids, and the multitude of pollinator-toxic pesticides, are critical factors in the cause of pollinator declines. Federal law, under the *Federal Insecticide, Fungicide, and Rodenticide Act*, protects as proprietary information on inert ingredients specific to pesticide products, unless the EPA Administrator determines there is a public health issue.

The study concludes, "Evidence of 'inert' ingredients having the potential to cause mortality in bees dates back to the 1970s, yet in the EU and U.S., there is still no regulatorily mandated toxicity testing of 'inert' ingredients. This means that the only currently available research stream is academic testing, which accounts for the small number of studies to date. As a result, this represents a large gap in our understanding of pesticide ecotoxicology. The research collated here demonstrates that 'inert' ingredients are not inert and can pose significant risks to bee health. We call on researchers to devote more attention to 'inert' ingredients and regulators to require testing of 'inert' ingredients to ensure their safety to bees."

As has been widely reported, pollinators (such as bees, monarch butterflies, and bats) are a bellwether for environmental stress as individuals and as colonies. Pesticides intensify pollinators' vulnerability to health risks (such as pathogens and parasites) with pesticide-contaminated conditions limiting colony productivity, growth, and survival. However, ending toxic pesticide use can alleviate the harmful impacts of these chemicals on species and ecosystem health. Beyond Pesticides captured the bigger picture in its introduction to its 2017 annual Pesticide Forum, *Healthy Hives, Healthy Lives, Healthy Land*: "Complex biological communities support life."

What to do: To find out more about what you can do to protect bees and other pollinators, check out information on the BEE Protective Campaign, pollinator-friendly landscapes, pollinator-friendly seeds, pesticide-free zones, bee-friendly habitats, and what you, or your state elected officials can do to protect our pollinators. For more information on the insect apocalypse, see the Beyond Pesticides article in our *Pesticides and You* journal, "Tracking Biodiversity: Study Cites Insect Extinction and Ecological Collapse."

Furthermore, buying, growing, and supporting organic agriculture can help eliminate the extensive use of pesticides in the environment. Organic land management eliminates the need for toxic agricultural pesticides. For more information on how organic is the right choice for consumers and the farmworkers who grow our food, see the Beyond Pesticides webpage, Health Benefits of Organic Agriculture. With Earth Day tomorrow, get ready to grow your spring garden the organic way by Springing Into Action, pledge to eliminate toxic pesticide use by signing the Ladybug Love Pledge and follow up with other actions.

SOURCE: Michelle Z Hotchkiss, Alexandre J Poulain, Jessica R K Forrest, Pesticide-induced disturbances of bee gut microbiotas, *FEMS Microbiology Reviews*, Volume 46, Issue 2, March 2022, fuab056, https://doi.org/10.1093/femsre/fuab056

MULTIGENERATIONAL EFFECTS TO BIRDS | SEPTEMBER 8, 2022

Ingestion of Real-World Pesticide Residues in Grain Threatens Birds' Offspring More than Parents

A study published in *Environmental Pollution* finds parental exposure to real-world, sublethal concentrations of pesticide residues on grains is a major contributor to unfavorable offspring development among foraging birds. Parents' ingestion of grains with conventional pesticide residues, whether from contaminated or pesticide-treated seeds, results in chronic exposure that adversely affects offspring health, even at low doses.

The adverse effects pesticides and other environmental pollutants have on birds are amply documented and researched. Although many studies evaluate acute or chronic health implications associated with pesticide exposure in a single generation, there is a lack of information on multigenerational impacts that can provide vital information on the fundamental survivability or fitness of bird species. Considering this study emphasizes parental exposure to environmental pollutants can have adverse consequences for future generations, it is necessary that future risk assessments for birds address these implications when implementing agricultural pesticide policies. The study notes, "[S]ublethal effects of such compounds [pesticides] on non-target species should be included in the regulation. Moreover, as agroecosystem pollution is not resulting only from pesticides, there is an urgent need to analyze cocktail effects, not only between molecules of pesticides but also between pesticides and other pollutants such as heavy metals."

The study considers the impact that mixtures of different pesticide residues at environmentally relevant levels have on foraging birds, specifically the grey partridge. Researchers fed 24 breeding pairs of birds grain from conventional agriculture containing pesticide residues and organic grains without pesticide residues as a control. The diet of grains mimics that of food availability encountered by wild birds in the environment. The researchers assess how the consumption of grain with pesticide residue impacts offspring growth and health through parental effects upon reproduction. The results demonstrate that while grains with pesticide residues fed to parent birds do not affect their current health (body mass index, red blood cell count, energy conversion) or egg-laying abilities, they do affect the birds' offspring. Researchers find that ingestion of low pesticide residues in grain has consequences on reproduction and offspring quality without altering mortality. Chicks whose parents consume grains with pesticide residues are more petite in size, lack proper skeletal growth, and have lower red blood cell counts with increasing body mass index as a trade-off.

Inheritance of genetic dysfunction relating to hereditary influence on gene expression is a familiar phenomenon. Various studies note that adverse genomic alterations can phase down to future

generations. As far back as 15 years ago, a Washington State University study linked pesticide exposure to multigenerational impacts on male fertility in rodents. More recently, researchers found that glyphosate (patented as an antibiotic) has adverse multigenerational effects, causing negligible observable impacts on pregnant rodents, but severe effects on the two subsequent generations, including reproductive (prostate and ovarian) and kidney diseases, obesity, and birth anomalies. New findings suggest exposure to the pesticide atrazine causes multigenerational resistance to the chemical in wasps by altering gut bacteria composition. Even banned pesticides like DDT still impact current and future generations, as the chemical (and subsequent metabolites) can cause multigenerational cancer, multigenerational obesity, and generational reproductive abnormalities via endocrine disruption. Moreover, chemical byproducts made during the pesticide manufacturing process, such as dioxin, have multigenerational consequences on reproductive health.

This study is one of the few to evaluate current levels of multiple pesticide residues in the ecosystem and their potential impact on birds in the wild. However, plenty of research demonstrates the toxicity pesticides pose to bird populations. As far back as 2013, the American Bird Conservancy published a report finding that just a single kernel of neonicotinoid (neonic)-coated corn is toxic enough to kill a songbird, highlighting the acute toxicity of pesticides on bird declines. A 2017 study found that neonicotinoids can disrupt songbird migration, making it more likely that a bird will die during its perilous migration route.

As confirmed in a 2019 study, pesticides like neonics usually are not killing migratory birds outright. Instead, exposure to these pesticides precipitates a cascade of sublethal impacts that reduces songbird fitness in the wild, making them more likely to die or be killed. Thus, this study reflects similar consequences among many foraging bird species, cautioning, "The consequences of parental exposure on chicks might partly explain the decline in wild Grey partridge populations, which raises questions for avian conservation and demography if current ARGOSystems approaches are continued."

Identifying pesticide residues on grain as a source of pesticide exposure is relevant when assessing the future risks pesticides impose on bird species. In addition to toxicity exposure, improper control regulations, poor manufacturing, and high application variability make pesticide residues problematic. The data from this study has implications for many bird species exposed to toxic chemicals at environmentally relevant levels.

What to do: Beyond Pesticides believes that we must eliminate pesticide use to mitigate the multigenerational impacts these chemicals pose on human and animal health. Therefore, future policy decisions on related pesticides should advocate for formidable safeguards on the agrochemical industry that ensure the ecosystem is safe from chemical hazards. In doing so, we can shift away from unnecessary reliance on pesticides. Adopting regenerative-organic practices and using least-toxic pest control can reduce harmful exposure to pesticides. Switch to organic to reduce wild birds' exposure to toxic pesticide residues and replace pesticide-treated seeds with organic seeds from Beyond Pesticides' organic seed directory. Learn more about pesticide-treated seeds and their harm by viewing Seeds that Poison. To see how you can protect your local bird population, learn more about pesticides' impact on birds and how an organic diet can help eliminate pesticide exposure.

SOURCE: Agathe Gaffard, Olivier Pays, Karine Monceau, Maria Teixeira, Vincent Bretagnolle, Jérôme Moreau, Feeding on grains containing pesticide residues is detrimental to offspring development through parental effects in grey partridge, Environmental Pollution, Volume 312, 2022, 120005, ISSN 0269-7491, https://doi.org/10.1016/j.envpol.2022.120005

AQUATIC ECOSYSTEMS THREATENED | SEPTEMBER 23, 2022

Neonicotinoid Insecticides Keep Poisoning California Waterways, Threatening Aquatic Ecosystems

According to a September 15 Environment California press release, California Department of Pesticide Regulation (CDPR) data confirm more bad news on neonicotinoid (neonic) contamination: nearly all urban waterways in three counties show the presence of the neonic imidacloprid at levels above the U.S. Environmental Protection Agency's (EPA's) chronic benchmark for harm to aquatic ecosystems; in five other counties, well over half show its presence at similar levels. Neonic use is strongly correlated with die-offs and other harms to a variety of bees and pollinators, and to other beneficial organisms. These startling metrics will make the state's efforts to protect such organisms even more challenging, according to Environment California (EC). See Beyond Pesticides' *Poisoned Waterways* report for a deep dive on neonics and their impacts in U.S. rivers, lakes, and streams.

The data represent 405 surface water samples taken between 2000 and 2020; those from urban waterways

in Los Angeles, Orange, and San Diego counties show that nearly 92% are contaminated at EPA benchmark violative levels; in Alameda, Contra Costa, Placer, Sacramento, and Santa Clara counties, 58% of waterways show such levels. Many of the counties with significant contamination are in the central coast and southern regions of the state. Some of this contamination no doubt comes from intensive agricultural use of imidacloprid, causing migration of the compound into waterways, but some may also be from nonagricultural uses—such as flea prevention for pets and building pest control products—common in developed urban areas. According to CDPR, there are 253 pesticide products containing imidacloprid registered for use in California.

Environment California's webpage hosts an interactive map of sampling sites (across much of the state) that are represented in those imidacloprid metrics. The percentage of samples from each location that contains the compound range from 0 to 91.67. The EC page notes that "very few samples were tested for imidacloprid prior to 2010. . . . [and that] the percentage of samples that detect imidacloprid remains fairly constant over time." Detailed results can be found in CDPR's Surface Water Database.

The 2017 Beyond Pesticides report mentioned above cites similarly alarming results in another of the state's waterways a decade ago: "A 2012 [CDPR] study using 2010 and 2011 surface water monitoring data from three agricultural regions in the state finds imidacloprid in 89% of the samples collected. . . . In the three agricultural regions studied, imidacloprid was detected in 85% of samples in Salinas, 93% in Imperial Valley, and 100% in Santa Maria Valley. These levels exceed currently established chronic aquatic benchmark concentrations."

No matter how they are deployed, neonics are systemic pesticides, meaning that plants germinate from coated seeds and/or take up the applied compound through their roots, after which it permeates the entire plant. This makes the plant's pollen, nectar, guttation droplets, and fruits toxic to creatures that feed on them.

Neonicotinoids (such as imidacloprid, acetamiprid, thiamethoxam, clothianidin, and dinotefuran) are a family of insecticides that harm the central nervous systems of insects and can paralyze or kill them, as well as have deleterious effects on baby bee brains. They are used as foliar sprays, plant root drenches, and granules to kill or render impotent a variety of pests—particularly sap-feeding insects, such as aphids, and root-feeding grubs. But a very significant vector for these compounds is through seed coatings, often for commodity crops (e.g., corn, soy, cotton). Ironically, years ago EPA released a report concluding that neonic seed coating provides little or no overall benefit in controlling insects or improving yield or quality in soybean production.

No matter how they are deployed, neonics are systemic pesticides, meaning that plants germinate from coated seeds and/or take up the applied compound through their roots, after which it permeates the entire plant. This makes the plant's pollen, nectar, guttation droplets, and fruits toxic to creatures that feed on them. Nontarget organisms,

such as birds, bees, butterflies, and bats, are poisoned when they forage among such contaminated plants. In addition to insects' exposures through foraging for food, it turns out that soil contaminated by neonics can also harm ground-nesting bees.

Neonics can persist over long periods of time in soils and are highly water soluble; thus, they can be transported via rain and/or irrigation systems into groundwater and waterways. They are detected regularly in sampling of the nation's waterways at concentrations that exceed acute and chronic toxicity values for sensitive organisms (as laid out in Beyond Pesticides "deep dive" report). Through a 2017 risk assessment, EPA found that "[C]oncentrations of imidacloprid detected in streams, rivers, lakes and drainage canals routinely exceed acute and chronic toxicity endpoints derived for freshwater invertebrates." Imidacloprid, one of the oldest neonics in commercial use, is especially persistent in aquatic environments and does not biodegrade easily; its half-life in water is generally longer than 30 days.

The neonic contamination of waterways—in California and across the nation—is very concerning because these compounds pose serious threats to keystone aquatic organisms, and can result in a complex, cascading impact on ecosystems. Aquatic insects and crustaceans are highly sensitive to neonicotinoids; the mayfly, a keystone species, has been identified as the most sensitive.

As Beyond Pesticides' *Poisoned Waterways* report notes, "Impacts on aquatic invertebrates can have cascading effects on food webs and healthy ecosystem function. [Even] low-level, sublethal exposures can result in decreases in species abundance, altered predator-prey relationships, [and] reduced water filtration and nutrient cycling." In addition, it points out that current federal aquatic life benchmarks for neonics may underestimate the risks: standard test organisms used by EPA to establish these benchmarks are, by orders of magnitude, more tolerant of neonicotinoid exposure than other vulnerable species.

Beyond impacts on aquatic life, terrestrial insects, pollinators, birds, and bats, neonics—touted by the agrochemical industry as safe for mammals—nevertheless are associated with a host of human health issues, including reproductive and endocrine system harms; possible renal, hepatic, developmental, and neurological damage; and possibly, indirect carcinogenic impacts related to the endocrine system.

Beyond impacts on aquatic life, terrestrial insects, pollinators, birds, and bats, neonics nevertheless are associated with a host of human health issues.

In response to this new CDPR dataset, Environment America's Conservation Program Director Steve Blackledge commented, "Every Californian knows the importance of having access to safe, clean water. Neonics like imidacloprid are causing harm not only to our pollinators and birds on land but also to our aquatic wildlife. Neonics are also being found in our bodies and despite being framed as 'mammal-safe,' recent research suggests that neonic exposures may increase the risk of developmental and neurological harms."

EPA has been extremely negligent in taking protective action against the neonic family of insecticides. Indeed, in March 2022, Beyond Pesticides covered its draft decisions on the registration review of five neonics: imidacloprid, dinotefuran, clothianidin, thiamethoxam, and acetamiprid. The organization wrote then, "Despite the agency's own findings of evidence of serious threats to pollinators, aquatic invertebrates, and other wildlife, it issued interim decisions on these neonics . . . that disregard the science on the pesticides' impacts. EPA appears to be prepared to finalize these registrations. . . . [T]his would, barring further action, extend the use of these harmful compounds *for 15 years*." The schedule for the review processes for these compounds can be found here.

California legislators have passed a "Save the Bees Bill," Assembly Bill 2146, which currently awaits the governor's signature. [Update: Governor Gavin Newsom vetoed the bill on September 28, pointing to ongoing regulatory review of neonics.] The bill aims to end nonagricultural uses of neonics on lawns, golf courses, and home gardens, beginning in 2024. News outlet KSBW8 has opined that if signed, the enacted law "could significantly impact the Central Coast and its agriculture." No doubt this would also be true for other regions, watersheds, and waterways in the state.

Environment California is encouraging Governor Gavin Newsom to sign the bill ASAP. Said the organization's state director, Laura Deehan, "We want to make California the next state, and the largest, to take this important step. The bill already passed through the Legislature, so we're now urging Gov. Newsom to sign the bill into law. We must prioritize the preservation of our pollinators over the short-term convenience of massive pesticide use."

What to do: Beyond Pesticide agrees that Governor Newsom should sign this bill, which would enact some protections in the state against the ravages of neonic use. We encourage readers who live in California to contact the governor to advocate for his signature: 916.445.2841 or via the state website. Other states, localities, and entities have taken action to restrict uses of this class of pesticides, including Maine, Maryland, Massachusetts, Vermont, New York, New Jersey, Portland, Oregon, and Emory University. At the federal level, it is imperative that EPA create much stronger regulation of neonics—a ban being the most protective of organisms, ecosystems, public health, and water resources.

SOURCE: Environment California. Pesticide linked to bee die-offs found in California's urban waterways. 2022

CONTAMINATED SEDIMENT HARMS WATER RESOURCES | OCTOBER 4, 2022

Pesticides in Sediment Contribute to Secondary Source of Chemical Pollution in Aquatic Environments

A study published in *Environmental Pollution* finds pyrethroid insecticides contribute to a secondary source of contamination in water resources. Various pyrethroids, including bifenthrin, are detectable in urban catch basins (storm drains) that collect runoff water before draining into the open environment. There is a lack of information regarding the pesticides' presence in urban catch basins. However, pesticide contamination in water resources is historically commonplace and widespread throughout U.S. rivers and streams, with at least five different pesticides present in 90 percent of water samples.

Moreover, thousands of tons of pesticides not only enter waterways (e.g., rivers, streams, lakes, oceans) around the U.S. through urban catch basins, but agricultural and nonagricultural sources as well, contaminating essential drinking water sources, such as surface water and groundwater.

During time frames when pesticide inputs decrease, all pyrethroid residues remain suspended in catch water basin soils, contributing to a secondary source of aquatic ecosystem contamination.

Reports like these are essential for determining appropriate regulatory action to protect human, animal, and environmental health from chemical contamination, especially if it is highly detectable. The study notes, "The high detection frequency of bifenthrin and overall pyrethroid concentrations, especially for particle-bound residues, suggest that underground urban catch basins constitute an important secondary source for extended and widespread contamination of downstream surface waters by pesticides such as pyrethroids in urban regions."

The urban areas contain underground catch basins responsible for collecting runoff for drainage into waterways. Pesticides contaminate runoff into these catch basins, implicating a secondary source of contamination in aquatic environments. Thus, the researchers gathered several water samples from urban underground catch basins throughout various U.S. California regions. (The samples emphasize the occurrence and profile of pyrethroid insecticides during the spring, summer, and fall.) Overall, the study finds that 98 percent of water samples contain detectable levels of pyrethroids. Of the individual pyrethroids, bifenthrin is the most detectable pyrethroid occurring in 97 percent of water samples, while the pyrethroid fenpropathrin is undetectable in samples. In addition to the highest detection frequency, bifenthrin also causes severe toxicity to sensitive aquatic invertebrates in 89

percent of samples. However, during time frames when pesticide inputs decrease, all pyrethroid residues remain suspended in catch water basin soils, contributing to a secondary source of aquatic ecosystem contamination.

Synthetic pyrethroids are toxicologically similar derivatives of naturally occurring pyrethrins, which have dramatically shorter half-lives and extreme sensitivity to light, heat, and moisture. These insecticides can irritate the eyes, skin, and airways, causing high acute toxicity symptoms (e.g., asthma, incoordination, tremors, and convulsions) depending on the chemical formula. However, these chemicals also have links to chronic health problems from developmental and endocrine disruption adversely affecting reproduction and sexual development to immune system dysfunction and increased chances of cancers. Moreover, synthetic pyrethroids are extremely toxic to aquatic organisms, including crustaceans, fish, and macro/microorganisms responsible for ecosystem function and services.

While synthetic pyrethroids pose significant dangers to the environment and human health, there is growing evidence that "inert" ingredients are causing just as much harm or more harm than the active ingredients in pesticide products. Toxic pesticide products can remain in the environment for months, years, and even decades. As the number of pesticides in waterways increases, it has detrimental impacts on aquatic ecosystem health, especially as some chemicals work synergistically with others to increase the severity of the effect. In addition to adverse health effects on marine organisms, these chemicals harm terrestrial organisms relying on the surface or groundwater. Additionally, disease vector pests like ticks and mosquitoes are developing resistance to chemical treatments, prompting the augmented use of chemical control methods, including the addition of toxic synergists like piperonyl butoxide (PBO), known to cause and exacerbate adverse health effects from exposure.

The study highlights how pervasive pyrethroids are in waterways and how these chemicals contribute to secondary chemical pollution through sediments. Pyrethroids are hydrophobic (do not mix with water) and accumulate in soils/sediments in aquatic environments.

Synthetic pyrethroids are toxicologically similar derivatives of naturally occurring pyrethrins, which have dramatically shorter half-lives and extreme sensitivity to light, heat, and moisture.

Soils/sediments can have anaerobic conditions lacking oxygen and slowing the degradation rate of pyrethroids, prolonging their persistence in the ecosystem. Thus, high levels of pyrethroid contamination impair invertebrate communities within sediments. However, this study is not the first to highlight the pervasiveness of pesticide compounds in ecological resources. Previous reports demonstrate the pervasiveness of pesticides, including pyrethroids, in urban watersheds and other waterways and resources from agricultural, household, and community insecticide treatments and pet spray runoff. Moreover, the ubiquity and persistence of certain compounds make it difficult to limit the number of toxicants that enter waterways. Many of the most commonly used pesticides in the U.S. are detectable in both surface and groundwater, which serve as drinking water sources for half of the U.S. population, raising another issue of deficient waterway monitoring and regulations that allow pesticides to accumulate in waterways.

The study concludes, "To improve understanding of pesticide behaviors in urban catch basins and USDSs [underground storm drains systems], further research should characterize runoff before and after it passes through a catch basin, the hydraulic retention of both water and solids in catch basins, and release of water and suspended solids from catch basins into the rest of the USDS. Efforts to design catch basins with reduced contaminant accumulation potential, and pest management practices to prevent the transport of pesticide residues from entering USDSs and catch basins, should be further explored."

What to do: Beyond Pesticides has long advocated for healthier and more environmentally friendly pest management practices to protect the environment and wildlife, particularly water resources. Therefore, toxic pesticides should be phased out and eliminated to protect the nation's and world's waterways and reduce the number of pesticides that make their way into your drinking water. Additionally, Beyond Pesticides has long advocated for regulations that consider potential synergistic and additive threats, to ecosystems and organisms, from admixtures of pesticides —whether in formulated products or "de facto" in the environment. However, advocating for local and state pesticide reform policies can protect you and your family from pesticide-contaminated water. Furthermore, organic/regenerative systems conserve water, nurture fertility, reduce surface runoff and erosion, reduce the need for nutrient input, and eliminate the toxic chemicals that threaten many aspects of human and ecosystem life, including water resources. For more information about pesticide contamination in water, see the Threatened Waters program page and Beyond Pesticides' article Pesticides in My Drinking Water? Individual Precautionary Measures and Community Action.

SOURCE: Nathan D. Sy, Sarah S. Wheeler, Marcia Reed, Eric Haas-Stapleton, Trinidad Reyes, Mir Bear-Johnson, Susanne Kluh, Robert F. Cummings, Tianyun Su, Yaxin Xiong, Qingyang Shi, Jay Gan, Pyrethroid insecticides in urban catch basins: A potential secondary contamination source for urban aquatic systems, Environmental Pollution, Volume 314, 2022, 120220, ISSN 0269-7491, https://doi.org/10.1016/j.envpol.2022.120220.

WEED KILLER DESTROYS SOIL LIFE | NOVEMBER 11, 2022

Weed Killer Use Destroys Soil Life and Ecosystems, Paper Finds

A paper published in *Trends in Ecology & Evolution* in late October sounds an unnerving alarm about the globally ubiquitous use of herbicides and the ecological destruction being caused. It asserts that widespread environmental contamination with these herbicide compounds is influencing soil, plant, and animal microbiomes in ways that are not only not well understood, but also can have significant impacts on the functioning of organisms and their ecosystems—with evolutionary implications. Impacts of herbicides on microbiota in soils include, for example, those on nutrient cycling, and altered organism and plant performance, which can affect pollination and animal consumption of plants. This research reinforces what Beyond Pesticides wrote in covering a 2021 study: "The popular herbicide glyphosate negatively affects microbial communities, indirectly influencing plant, animal, and human health. Exposure to sublethal concentrations of glyphosate shifts microbial community composition, destroying beneficial microorganisms while preserving pathogenic organisms."

Herbicides are a category of pesticide used to control weeds in agriculture and commercial forests, on managed landscapes, byways, gardens, and lawns, and directly on surface waters to control aquatic weeds. They are designed to kill "target" plant species considered undesirable in any of those circumstances. Herbicide use has exploded in the past two decades, in large part due to the advent of the agro-biotech industry's deployment of genetically modified, herbicide-tolerant crop seeds that pair with herbicide use.

This increased use has ramped up the development of weeds' resistance to multiple herbicides. Glyphosate formulations (including the infamous Roundup) are the most commonly used, in agriculture, horticulture, silviculture, and urban environments. In the aggregate, glyphosate contributes mightily to global environmental contamination; other widely used herbicides include [triazines (e.g., atrazine), acetochlor and metolachlor, paraquat, and dicamba. Residues of herbicides are found in soil, water, non-target plants, animals, and humans, and are associated with pollinator and insect declines and biodiversity losses, compromise of other organisms (including keystone species), ecosystem dysfunction, and human health anomalies.

The study authors also note that adjuvant, "inert" ingredients in herbicide formulations can sometimes be even more toxic to nontarget organisms than the active ingredients themselves, and that in the U.S., such co-formulants are not required to be tested for toxicity to nontarget organisms. To make matters worse, information about such adjuvants is usually considered "proprietary" and therefore, is not shared with regulators or the public. Beyond Pesticides has covered this "inert" ingredient phenomenon.

If present patterns persist, the use of herbicides is predicted, by *BusinessWire*, to increase annually by 2–3% through 2025. Most of that increase is expected in the agricultural sector

because of (1) increasing resistance to herbicides by weed species, (2) an increase in agricultural intensity in Central and South America and the Asian/Pacific region, and (3) the ongoing development of new herbicide formulations (in part because of #1) and "herbicide use education" in developing markets.

Though herbicides are designed for target species, they also expose nontarget plants, animals, humans, and ecosystem function to risks. This study focuses on the compounds' effects on microbiota in flora, fauna, and soils. The authors assert that, "While many herbicides were initially considered safe for non-target taxa, as their mechanism of action was thought to be absent in these organisms, it has been understood only recently that herbicides may have profound effects on non-target taxa via alterations of microbial communities and microbial function in soil, plants, and animals. Given the imperative role of microbes in driving eco-evolutionary adaptations since the origin of life, and that microbes and their hosts comprise coevolving, multipartite entities [known as holobionts], a comprehensive understanding of the risks associated with altered microbiomes is needed." (A holobiont is an assemblage of a host and the many other species living in or around it, which together form a discrete ecological unit through symbiosis.)

The assumption that herbicides would be safe for nontarget taxa was based on the idea that their modes or mechanisms of action—how the compounds actually work to kill or disable weeds—were lacking in nontarget organisms. More-recent research has shown, however, that these compounds' mechanisms of action can have profound effects on the microbial communities harbored by nontarget organisms. These communities, or microbiota, are present in all living things and are critical to healthy organism function—and to optimal immune response in particular, a primary task being the control of pathogens. When herbicides damage or kill a plant or animal's resident microbes, they alter the organism's ability to execute this protective function.

The study identifies classes or modes of action for a host of herbicide active ingredients, including whether they act directly or indirectly on microbiota, and their respective effects on soil, plant, or animal microbiomes. Among the modes (and sample compounds) that have direct impacts on microbes are:

- ACC (acetyl-CoA carboxylase) inhibitors (e.g., diclofop-methyl, haloxyfop)
- ALS (acetolactate synthase) inhibitors (sulfonylureas, triazolopyrimidines)
- EPSPS (5-enolpyruvylshikimate-3-phosphate synthase) inhibitors in the shikimate pathway (glyphosate)
- glutamine synthetase inhibitors (glufosinate)

Effects on resident microbiomes include those that damage microbes' role in nutrient cycling, compromise immune response, alter soil carbon and phosphorous dynamics, and degrade population levels.

The mechanisms that exhibit indirect impacts, including on cellular metabolism and hormone synthesis, are auxin-like herbicides (2,4-D, dicamba); photosystem (related to photosynthesis) inhibitors (triazines, paraquat, diphenyl ether); and gibberellin (plant hormone that stimulates stem elongation, germination, and flowering) inhibitors (acetochlor, metolachlor, pendimethalin). The indirect impacts on microbiota include those that degrade bacterial diversity, erode microbial community structure, and disable nitrogen-fixing bacteria.

Herbicides alter microbial communities through multiple pathways; factors that influence such alterations include differing vulnerability to the compounds across microbe type; some microbes' utilization of herbicides as nutritional sources; and functional changes that can cascade to have "community-wide" impacts. An example of that last is that healthy microbiomes exhibit successful, long-term self-regulation; herbicide exposures can have damaging effects on that ability.

Soil- and root system–associated microbes are critical to functioning ecosystems, and herbicides' impacts on them depend on several elements: the compounds' chemical composition and mode of action, soil health, and climate, among others. The dynamics of herbicides in soil microbiota are complex, and thus, can be hard to predict. Examples the study cites are these: "Glyphosate negatively affects shikimate pathways present in the majority of microbes, but their genetic resistance to glyphosate varies. Therefore, some of the resistant and glyphosate-degrading microbes that can use glyphosate as a nutrient source may become prevalent in the microbial community. . . . Similarly, in some environments atrazine may not affect the overall microbial community, while in other environments it can decrease soil microbial biomass or increase atrazine-degrading bacteria due to strong selection favoring them, thus leading to atrazine degradation." (The shikimate pathway is one of many physiological pathways that impact plant defense and signaling chemistry.)

The study concludes that the ecological and evolutionary consequences for microbial soil communities are poorly understood and require further research. But the authors posit that other research has demonstrated a negative correlation between pesticide use and (1) beneficial soil- and root-associated microbes, and (2) herbicide-modulated nutrient cycling.

The team also asserts that herbicide residues can cause disruptions in dynamic relations between mycorrhizal fungi and their associated plant communities, and reduction in abundance of nitrogen-fixing bacteria. They note: "As many plant traits, including growth, phenology, and resistance to abiotic stressors and pathogens, are modulated by rhizosphere microbiome, changes in rhizosphere composition and functioning are likely to be reflected in host fitness and growth. . . . [S]ublethal doses of glyphosate [for example] can potentially disrupt virtually all plant above-ground interactions with other coevolving organisms, such as pathogens, plant-mutualistic microbes, herbivores, and pollinators."

The study also points to deleterious impacts on animal gut and skin

microbiomes, which play important roles in digestion, pathogen management, and neurobehavioral coordination. Glyphosate, the paper notes, "has been shown to increase pathogenic and decrease symbiotic bacteria, which may affect the susceptibility of bees to viral and fungal pathogens, with survival effects cascading to the ecosystem level.... [H]erbicide-altered plant microbiomes and/or metabolomes in plant leaves, pollen, and nectar may alter the exposure and consumption of pollinators and herbivores, which can have cascading effects on their gut microbiomes and, therefore, the health of the pollinators and herbivores." This is a demonstration of how herbicide-driven alterations in animal-host gut microbiomes can lead to ecosystem-level changes.

Last, the research addresses the "widely known evolutionary consequence of repeated herbicide exposure"—selection for increased herbicide resistance in soil bacteria. This resistance, the authors assert, can feed back to the ecosystem level when changes in the microbial community composition influence soil processes; they cite nitrogen and carbon flows as examples. They add, "Long-term exposure to herbicides may influence not only microbial evolution but also the evolution of the animal hosts driven via microbes," and cite the example of a particular wasp variety's chronic atrazine exposure causing adaptive gut changes that then exerts selective pressure on its host genome.

The health of microbial communities is hugely important. These tiny organizations of organisms maintain individual plant, animal, and human health, and that of ecosystems. Altering these communities—particularly in soils, through prolonged assault with toxic herbicides (and other pesticides)—can have, the authors assert, "far-reaching, long-term, and unforeseen impacts on ecosystems." We are witnessing these chemical impacts unfold in the current trend toward a collapse of biodiversity that threatens all life on Earth. (Other factors contribute, of course—the climate crisis, human-caused development that destroys habitat, pollution, overexploitation of natural resources, and problematic invasive species.)

But this research (and more here) identify a threat that has great potential to accelerate the distortion and potential destruction of organisms and ecosystems. The issue of herbicides' and pesticides' impacts on microbiomes, especially in our soils, needs more research and certainly, should be part of the U.S. Environmental Protection Agency's (EPA's) risk evaluations of herbicides and pesticides.

Meanwhile, as Beyond Pesticides advocates with growing volume and urgency, the "fix" for insect, weed, and animal "pests" (in agriculture, and in other land and building management) is *not* the agrochemical industry's never-ending chase of evolving organisms' resistance to chemical assaults with new, more, and more-intensive chemical applications. This approach will never "win" the contest with the living world's mutation-plus-selection strategy for organismic survival.

What to do: What *can* work is a change in approach, on the order of "work smarter, not harder." Organic approaches to agriculture, in particular, but to all land and pest management, are effective, holistic, protective, and benign ways to deal with pests, and can achieve production and land management goals—without the toxic, systemic, destructive, and sometimes unknown, impacts of chemical saturation of the environment and ecosystems, natural resources, and organisms across the living spectrum. Learn more about the environmental, health, and socio-economic benefits of organic, and please advocate for this critical transition (see our Tools for Change). You can reach out to Beyond Pesticides for assistance with this work in your community: email us at info@beyondpesticides.org or call 202.543.5450.

SOURCE: Ruuskanen, Suvi et al., Ecosystem consequences of herbicides: the role of microbiome. Trends in Ecology & Evolution, vol.38, no. 1, p35-43. October 13, 2023

TREE SPRAYING DESTROYS BIOLOGICAL CONTROL | NOVEMBER 16, 2022

Pesticide Spraying of Urban Trees Found To Disrupt Natural Biological Management of Landscapes

Putting up with moderate pest levels can attract and maintain predators and parasitoids that provide important biological control services throughout the landscape, according to research recently published in *Environmental Entomology*. While scale insects can be a problem in urban areas, dropping sticky "honeydew" on cars and structures, they also play a critical role in maintaining native populations of pest predators. Scientists at North Carolina State University (NCSU) set out to understand just how important these pest populations are at maintaining their own natural enemies.

To do so, researchers worked through a series of three hypotheses on the connection between urban trees, scale insects, and pest predators. Focus was first placed on investigating different oak species and comparing the number of predators between trees infested and not infested with scale. Twigs from willow oaks, sawtooth oaks, and overcup oaks were collected from scale infested and scale uninfested trees on

the NCSU campus over the course of spring and counted for their scale abundance. Then, through the summer, researchers used a sampling tool that effectively shook insects out of the tree and into a funnel collection.

Unsurprisingly, scale infested oaks contain more scale insects. But these trees also host significantly higher numbers of pest predators, with greater numbers of spiders, parasitoids, ants, and lady beetles found in infested oaks.

Scientists next aimed to see whether more predators were disbursing into the landscape from infested oaks than uninfected oaks. This was measured by hanging intercept traps—plastic cups filled with soapy water—under the oaks for two days, repeated for a total of five replicates. Results show no difference between the predators captured in either infested or uninfested trees, with no significant differences between tree types.

The last experiment aimed to test the hypothesis that shrubs underneath infested trees hosted higher levels of pest predators than uninfested trees. This was revealed by the use of a vacuum sampler on holly shrubs located beneath the trees. Vacuuming was repeated for a total of 26 scale infested trees and 23 uninfested trees. Multiple different sampling methods were conducted, including three-, six-, and nine-day comparisons over the course of several months.

In general, shrubs underneath scale infested trees contain significantly more pest predators than those underneath uninfested trees. This difference increased over the course of sampling time, with three-day samples showing less difference than nine-day samples.

These findings underscore the importance of patience and timing within the natural pest management approach. After identifying a tree pest, for many community land managers there is a knee-jerk reaction to spray as soon as it is identified. But as study coauthor Caleb Wilson, PhD, notes in an article discussing the paper, "Treating a tree with pesticides could kill off natural enemies that would otherwise help manage nearby pests. In other words, treating a tree with pesticides could alleviate pest problems within the tree but could result in pest outbreaks in shrubs beneath the tree as natural enemies are killed off."

By taking a broader, systems view of the landscape, rather than focusing on a single tree with a single pest, moderate levels of pest populations in trees can be considered a resource rather than a liability.

What to do: Biological approaches to pest management are critical for a sustainable future yet are in need of considerably more research and investment. The return on investment is sound—biological management has resulted in billions of dollars in benefits to agricultural economies, placing it on equal footing with the impact of the green revolution, according to a 2020 study.

Take steps to move toward a pesticide-free, organic systems approach to pest management on your yard and in your community by learning more and sending a letter to your local elected officials today.

SOURCE: https://academic.oup.com/ee/advance-article/doi/10.1093/ee/nvac081/6763314?login=falseCaleb J Wilson, Steven D Frank, Scale Insects Support Natural Enemies in Both Landscape Trees and Shrubs Below Them, *Environmental Entomology*, Volume 51, Issue 6, December 2022, Pages 1094–1105, https://doi.org/10.1093/ee/nvac081; Entomology Today

ANTIBIOTIC/ANTIFUNGAL RESISTANCE | FEBRUARY 23, 2022

Deadly Fungus Resistant to Fungicide Jumps from Farms to People, as Human Pathogen Spreads

Fungicide use in agriculture is driving the spread of multi-fungicide resistant human pathogens, finds a recent study conducted by scientists at the University of Georgia. While this occurrence has long been an assumption based on the rampant overuse of fungicides in chemical-dependent farming, scientists have now found clear evidence linking the development of widespread fungal resistance to farming practices, rather than health care use. Despite strong evidence that commonly used synthetic pesticides in chemical-intensive farming are driving resistance that threatens human health on a global scale, the U.S. government has not only failed to take action, it has fought against international efforts to slow the crisis, at the behest of the agrichemical industry.

Scientists focused their research on *Aspergillus fumigatus,* a common mold that can infect humans and cause aspergillosis. Although some have problems with mild sensitivity to the fungus, virulent infections, called invasive aspergillosis, can occur in immunocompromised individuals and are on the rise. Cases of invasive aspergillosis increased 3% per annum between 2000 and 2013, and roughly 300,000 worldwide are diagnosed each year. On both farms and in human medical settings, antifungal compounds, called azole fungicides, are used in an attempt to kill off *A. fumigatus* infection.

Samples were taken from soil, compost, or plant debris from 56 farms in Georgia and Florida, with 53 of those sites having previously used azole fungicides. Of the remaining three, two samples were taken from organic farms and one was taken from a compost pile.

Of 700 *A. fumigatus* samples collected, nearly 20% (123) displayed some level of resistance to the commonly used azole fungicide tebuconazole. Twelve of the 123 were highly resistant at clinically relevant levels for human health care. No samples taken from organic sites contained resistant fungi.

It is hypothesized that if the strain of *A. fumigatus* infecting people develop its resistance traits on a farm, that strain would also have developed some level of resistance to other, non-azole, agricultural fungicides. Sure enough, the azole-resistant strains also display resistance to methyl benzimidazole carbamate (MBC) fungicides like carbendazim, and quinone outside inhibitors (QoI) like azoxystrobin.

By sequencing the genomes of *A. fumigatus* samples both from the current study and those taken and stored from clinical tests across the world, researchers were able to create a neighbor-joining tree—a sort of family tree of fungicide resistant *A. fumigatus*. That review shows that genetically, pan-azole resistant strains—those with broad resistance to azole fungicides—match up closely between those discovered on farms and those found in human clinical

settings. Of 25 pan-azole resistant samples analyzed, eight farm samples and 12 human clinical samples also display resistance to non-azole fungicides.

"The strains that are from the environment and from people are very closely related to each other," study coauthor Marin T. Brewer, PhD, said. "It's not like there are different strains that are developing resistance in people and in the environment. It's all the same. So people who have these infections that are resistant have likely acquired them from the environment."

Aspergillus fumigatus is commonly found both indoors and outside. Infection can occur by simply inhaling a small amount of the fungi.

This result is merely the latest resistant pathogen to trace its lineage back to on-farm use. Over the last decade, scientific evidence has built around the link between common herbicides and antibiotic resistant bacteria. A 2015 study found that *Salmonella* and *E.coli* exposed to the herbicides glyphosate, dicamba, and 2,4-D triggered a non-specific defense mechanism which, while building resistance to the toxic effects of the herbicides, also resulted in resistance to commonly used antibiotics. Subsequent research has found soil sprayed with these same herbicides to have higher numbers of antibiotic resistant bacteria than areas where the chemicals were not applied. The resistant genes move throughout the environment by "horizontal gene transfer," elevating the importance of land and agricultural management practices that eliminate antibiotics and fungicides.

Another problematic fungal pathogen, the yeast *Candida auris*, continues to rapidly develop treatment resistance in human clinical settings, linked to the excessive use of fungicides. Researchers say their results indicate a need for a shift toward alternatives that do not cause resistance to human pathogens. "This emergence severely limits the usefulness of fungicides to manage plant pathogens while still preserving the clinical usefulness of azoles," Dr. Brewer said. "We urgently need effective agricultural fungicides that aren't toxic to the environment that do not lead to the rapid development of widespread resistance in the clinic."

While the call is laudable, regulators and politicians are neither heeding the science, nor listening to scientists. The U.S. Environmental Protection Agency's recent response to the rise of drug-resistant *Candida auris* is case in point. The agency failed to assess the efficacy of any pesticides that are not used for public health purposes; EPA only evaluates the efficacy of antimicrobial compounds whose use patterns classify them as human-health-related.

At the international level, a *Freedom of Information Act* request reveals officials at the U.S. Department of Agriculture working to downplay the role of synthetic fungicide use in chemical agriculture as a factor in the rise of drug-resistant fungal infections worldwide. Not only do they work to deny the truth on the ground, efforts have been made to halt protective actions. Emails show top level officials at industry trade group CropLife America urging USDA officials to "make certain" that the United Nation's (UN) *Codex Alimentarius*, a set of international guidelines and standards established to protect consumer health, made no mention of how fungicides contribute to antibiotic resistance.

What to do: Organic agriculture, with its strong restrictions on allowed synthetic materials, provides a path forward that does not allow synthetic antibiotics and fungicides. For more reasons to go organic, see Beyond Pesticides' Why Organic webpage.

SOURCE: S Earl Kang, Leilani G Sumabat, Tina Melie, Brandon Mangum, Michelle Momany, Marin T Brewer, Evidence for the agricultural origin of resistance to multiple antimicrobials in *Aspergillus fumigatus*, a fungal pathogen of humans, *G3 Genes|Genomes|Genetics*, Volume 12, Issue 2, February 2022, jkab427, https://doi.org/10.1093/g3journal/jkab427; University of Georgia press release

GLYPHOSATE INDUCES ANTIBIOTIC RESISTANCE | NOVEMBER 18, 2022

Glyphosate Induces Antibiotic Resistance in Deadly Hospital-Acquired Infection

Glyphosate weed killers induce antibiotic resistance in deadly hospital-acquired bacteria, according to a study published late last month in the journal *Scientific Reports*. This is the latest finding connecting commonly used herbicides to the rise of antibiotic resistant bacteria, with prior research showing glyphosate, 2,4-D, and dicamba able to create resistance in *Salmonella* and *E. coli*. Federal regulatory agencies continue to ignore the role of pesticides in the development of antibiotic resistance. This is all happening as antibiotic resistance is rising to dangerously high levels in all parts of the world, according to the World Health Organization. In the May 1, 2022 issues of the *Bulletin of the World Health Organization,* Samira Choudhury, PhD, et al. writes, "Often referred to as the silent pandemic, antimicrobial resistance claims the lives of over 700,000 people annually." The authors continue, "A study suggests that if no actions are taken, antimicrobial resistance will cause 10 million deaths per year by 2050 and an economic impact of over 100 trillion United States dollars."

Scientists focus their research on *Pseudomonas aeruginosa,* a bacteria commonly found in the environment, but able to cause serious disease in humans.

Healthy people can be infected from improperly cleaned hot tubs or swimming pools, resulting in skin rashes and eye and ear infections. However, the greatest risk of *P. aeruginosa* is in the hospital setting. The bacteria is well known to infect those suffering from burn wounds, on a ventilator or other invasive medical device, or with a catheter. Hospital-acquired *P. aeruginosa* is deadly in large part due to the wide spectrum of multi-drug antibiotic resistance the bacteria possesses. The U.S. Centers for Disease Control and Prevention indicates that in 2017 32,600 Americans hospitalized came down with a *P. aeruginosa* infection, with 2,700 passing away as a result.

To better understand the role pesticides like glyphosate are playing in these deadly infections, scientists in the study examine five different strains of *P. aeruginosa,* four retrieved from the environment and one from a clinical setting. All represent strains that were initially sensitive to antibiotics.These strains were exposed to both technical grade glyphosate and a range of glyphosate-based herbicide (GBH) formulations, including the products Roundup Mega, Dominator Extra 608 SL, Gladiator 480 SL (which are sold only in Europe). *P. aeruginosa* was exposed to 0.5% of glyphosate and GBH products per the volume of the medium (equivalent to 1.8–2.8 g/L [glyphosate] acid depending on the type of formulation). "This concentration falls within the recommended dilution range of GBHs [0.2–3.5% (v/v)] for agricultural and household use and similar to those found in water after agricultural practices," the study notes.

At this level, glyphosate and its formulated products significantly increase the minimum inhibitory concentration (the lowest concentration of an antibiotic that would inhibit the growth of a given bacteria) of *P. aeruginosa* to the carbapenem-type antibiotic, imipenem, by between 2-32 fold. This occurred in all strains and under different exposure scenarios. "Considering the worldwide use of [glyphosate] and GBHs, and the simultaneous emergence of antibiotic-resistant bacteria in environmental matrices, the detected interactions between these chemicals may affect microbial communities and possess a potential environmental and human health risk," the authors explain. Future studies will likely determine the mechanism through which this problem is occurring

It is becoming increasingly evident that glyphosate is creating resistance problems in more than merely the weeds on which the chemical is being applied to control. Initial reports on glyphosate's antibiotic resistance properties came in 2015, a week after the chemical was deemed a possible carcinogen by the World Health Organization. Two years later, these reports were confirmed in greater detail by the same team of scientists. In 2018, researchers found that bacteria exposed to glyphosate-based Roundup can develop antibiotic resistance 100,000 times faster than average. The most recent findings indicate that this resistance is developing directly in the field, with soils sprayed with weed killers likely to contain higher amounts of antibiotic resistant bacteria.

The regulatory response to this near-decade of research on the antibiotic resistance properties of commonly used herbicides has been nil. While the U.S. Environmental Protection Agency (EPA) requires herbicide product labels to include information on abating weed resistance, antibiotic resistance is not mentioned.

With inaction from federal regulators, it is up to states and localities to protect their residents from the rise of pesticide-induced antibiotic resistant bacteria. *Pseudomonas aeruginosa* is known to attack the most vulnerable at their weakest stage. Yet, it is perfectly possible for a landscaper to be spraying glyphosate outside of the room of a patient suffering from a *P. aeruginosa* infection.

Resistant bacteria travels throughout the environment through a process called horizontal gene transfer, causing widespread resistance even if the use site of the chemical does not come into direct contact with someone suffering from or vulnerable to an infectious disease. The human pathogenic organisms themselves do not need to be directly sprayed by the antibiotic because movement of genes in bacteria is not solely "vertical" –that is from parent to progeny– but can be "horizontal"—from one bacterial species to another.

What to do: Stopping the use of carcinogenic, antibiotic resistance forming pesticides outside hospitals where individuals are suffering from the diseases these chemicals can cause is common sense. But Beyond Pesticides challenges individuals to find hospitals that are paying attention and considering the connection between their landscape practices and the health of their patients. Although some, like the Adventist Hospital in Takoma Park, MD, stopped their use of pesticides and supported the passage of local laws restricting their use, medical sector involvement is unfortunately rare. More broadly, use of pesticides that cause bacterial resistance to antibiotics in agriculture is contributing to widespread resistance throughout society, making it more and more difficult to treat infectious diseases with antibiotics. Individuals concerned about this problem, who may have had family members or friends poisoned by pesticides or harmed by antibiotic resistant diseases, are encouraged to get active in their community to fight for meaningful protections from toxic pesticides. Tell your local officials to transition your community landscapes to pesticide-free, organic management.

SOURCE: Háhn, J., Kriszt, B., Tóth, G. *et al.* Glyphosate and glyphosate-based herbicides (GBHs) induce phenotypic imipenem resistance in *Pseudomonas aeruginosa*. *Sci Rep* 12, 18258 (2022). https://doi.org/10.1038/s41598-022-23117-9

MONARCHS THREATENED BY STORE-BOUGHT PLANTS | SEPTEMBER 13, 2022

Multiple Pesticides Detected in All Store-Bought Milkweed, Threatening Further Monarch Declines

Every store-bought milkweed sample tested in a recent study contains multiple toxic pesticides, placing monarchs reliant on these plants in harm's way at a time the species can ill afford any further loss to its population. Pollinator declines have influenced many residents throughout the U.S. to take action into their own hands and transform their home yards or businesses into an oasis for bees, birds, and butterflies. Yet, a recent study published in *Biological Conservation* finds that many retailers are dousing their "wildlife-friendly" plants with pesticides that put this vulnerable species in further danger.

"That was the most shocking part," said lead author Christopher Halsch, a doctoral student at University of Nevada, Reno. "The fact that plants labeled as potentially beneficial or at least friendly to wildlife are not better and, in some cases, might be worse than other plants available for purchase. This research sheds light on how pesticides may impact western monarchs, but many other butterflies are facing even steeper population declines, and pesticides are likely one driver."

Testing was conducted by purchasing milkweed plants at 33 different stores spanning 15 different states. A sample of each plant was cut after purchase, and then sent to the lab for chemical analysis. Screening was conducted for 92 different pesticides, including insecticides, fungicides, herbicides, and the synergist piperonyl butoxide.

Out of the 92 pesticides tested, 61 compounds were discovered in milkweed samples. Every sample contains at least two pesticides, though certain plants contain over 25 different chemicals. Despite the importance of this iconic species, data on harmful effects of most pesticides on monarchs is sparse or lacking. Only 9 of the 61 compounds detected have been tested for their impact on monarch health. Yet, for the data that is available, researchers find that 89 samples exceed levels associated with sublethal effects in monarchs—exposures that may not outright kill a monarch, but may increase the likelihood of death in the wild. These sublethal effects are seen in 17 of 25 locations, driven primarily by the elevated presence of the fungicides azoxystrobin and trifloxystrobin.

"In a previous study in California that primarily looked at milkweed in agriculture and urban interfaces, we had looked at a small number of plants from retail nurseries, and found that they contained pesticides," study coauthor Matt Forister, PhD, said. "[W]e were prepared for this much larger sample . . . to again uncover contamination, but it was surprising to see the great diversity of pesticides found in these plants. In many ways,

they are as contaminated or even worse than plants growing on the edges of agricultural fields. That was a surprise, at least to me."

Prior investigations from the same research team did find wild milkweed growing in a range of habitats to be ubiquitously contaminated with pesticides. Published in 2020, their study found 262 different pesticides from over 200 milkweed samples collected from around 20 sites within California's Central Valley. "From roadsides, from yards, from wildlife refuges, even from plants bought at stores—doesn't matter from where—it's all loaded with chemicals" Dr. Forister said of the previous study.

Monarchs on both sides of North America are fairing extremely poorly in the face of multiple interacting stressors, including climate change, habitat destruction, and pesticide exposure. Eastern populations have declined by 80% since 2005, and western monarchs have shrunk an astounding 99.9% from their population of over 10 million in the 1980s. These numbers pose a significant risk of migratory collapse, and with it, potential extinction.

Despite this dismal state of affairs, Aimee Code, study coauthor and pesticide program director at the national nonprofit Xerces Society, notes that, "Everyone can take steps to address the risks we uncovered." She continued: "Consumers can let their nurseries know they want plants that are free from harmful pesticides. Nursery outlets can talk with their suppliers and encourage safer practices, and government agencies can improve oversight."

Instead of immediately ripping out your milkweed, Ms. Code indicates there are steps that can be taken to protect butterflies from the likely contamination. "And it's important to keep gardening for pollinators for the long-term, just take steps to reduce pesticide exposure: cover new plants the first year, water heavily, discard the soil before planting, as it may be contaminated, and avoid pesticide use."

It is critical that every possible step is taken to protect these iconic pollinators before it is too late. While the international conservation group, International Union for the Conservation of Nature (IUCN), is listing the monarch as endangered, the U.S. government has not taken similar action. The U.S. Fish and Wildlife Service (USFWS) determined in 2020 that monarchs were eligible for protection under the *Endangered Species Act*, but their listing was "precluded by higher priority actions." Is the ubiquitous threat of pesticides throughout the monarch habitat the reason USFWS is dragging its feet? In another recent listing, concerning the officially endangered Rusty-Patched bumblebee, USFWS declined to declare the species' critical habitat, precluding rules that could place restrictions that protect the species from toxic pesticide exposure. Some conservationists speculate that the federal government is failing to take action on pollinators as a result of the significant implications that the listing would cause to the pesticide industry.

What to do: Meaningful action at the federal level will take immense pressure from local residents and communities. Join Beyond Pesticides in telling U.S. Fish and Wildlife to officially list monarch butterflies as endangered species, so that they have access to additional protections needed to recover the population.

SOURCE: Christopher A. Halsch, Sarah M. Hoyle, Aimee Code, James A. Fordyce, Matthew L. Forister, Milkweed plants bought at nurseries may expose monarch caterpillars to harmful pesticide residues, Biological Conservation, Volume 273, 2022, 109699, ISSN 0006-3207, https://doi.org/10.1016/j.biocon.2022.109699; University of Reno press release

GREENHOUSE GAS FROM HOUSE FUMIGATION | JANUARY 11, 2022

Common Home Fumigation Pesticide Associated with Increased Greenhouse Gas Emissions

A study finds that the pesticide sulfuryl fluoride, used for insect (e.g., termites, bedbugs, cockroaches, etc.) fumigation treatments, increases greenhouse gas (GHG) emissions, according to the report, "Termite Fumigation in California Is Fueling the Rise of a Rare Greenhouse Gas." Not only do most sulfuryl fluoride emissions in the U.S. occur in California, but a majority of global emissions also occur in California. When the use of methyl bromide for agricultural and structural fumigation was phased-out under the Montreal Protocol, sulfuryl fluoride became a replacement for fumigation treatments. However, researchers have identified concentrations of sulfuryl fluoride in the atmosphere due to the chemical's long half-life and greenhouse warming potential (GWP). The *California Global Warming Solutions Act of 2006* does not list sulfuryl fluoride emissions as a GHG risk. Therefore, the researchers note, "This work emphasizes the importance of considering [sulfuryl fluoride] SO2F2 in state and national greenhouse gas inventories and emissions reduction strategies."

Researchers employ a geostatistical inverse model (GIM)—commonly used to estimate GHG fluxes—alongside atmospheric measurements of sulfuryl fluoride to estimate emissions throughout the United States. Using programmable flask packages (PFPs), researchers examine atmospheric observational data from towers, observatories, and aircraft, measuring concentrations of sulfuryl fluoride via gas chromatography-mass spectrometry. To compare surface and downwind emission, the researchers use the Lagrangian particle dispersion model (STILT) with multiple variables, including county-wide uses of sulfuryl fluoride and the U.S. Geographical Survey National Land Cover Database.

The GIM results demonstrate that most U.S. sulfuryl fluoride emissions derive from California, specifically the greater Los Angeles (LA) area (up to 400 parts per trillion between 2015 and 2017), followed by the Bay area. Moreover, all regions outside of California have negligible sulfuryl fluoride atmospheric concentrations, resulting in little to no emissions. Thus, the study implies California is the world's leading sulfuryl fluoride emitter. Lead author Dylan Gaeta, a PhD student at Johns Hopkins University, extrapolates, "We expected to see little splotches of emissions throughout at least some other parts of the country…The fact that we are seeing almost all of it from California? That was the shocking part."

Sulfuryl fluoride is a fluoride compound with various adverse health effects, including cancer, endocrine disruption, neurotoxicity (reduced IQ), and reproductive damage. The *Food Quality Protection Act* (FQPA) amendments to *Federal Food, Drug, and Cosmetic Act* (FFDCA) require that a pesticide registered for use by the

agency cannot exceed acceptable risk thresholds for both dietary and nondietary exposure. However, a U.S. Environmental Protection Agency's (EPA) risk assessment of fluoride exposure finds that exposure to fluoride from various sources (e.g., sulfuryl fluoride residues in food commodities, fluoride exposure in water and toothpaste) did not meet the safety standard under FFDCA. Moreover, sulfuryl fluoride rapidly metabolizes (breaks down) in the body into fluoride. Considering the compound has a long half-life in human bones (~20 years), advocates have in the past petitioned EPA should withdraw the allowed tolerances for food uses of sulfuryl fluoride.

Sulfuryl fluoride, registered for termite and other wood-boring pest extermination in 1959, gained additional attention as a potential alternative to methyl bromide, a broad-spectrum insect fumigant used in post-harvest storage and food processing facilities. Methyl bromide's designation as a greenhouse gas under the Montreal Protocol (2005) caused a gradual reduction in use. However, when no feasible methyl bromide alternatives are available, the "critical use exemption" (CUE) allows the use of this chemical. Furthermore, others (Natural Resources Defense Council) argue that the disallowance of any sulfuryl fluoride uses will lead to prolonged or increased methyl bromide use. However, Beyond Pesticides and others maintain that without the phaseout of sulfuryl fluoride, there will be no incentive for grain storage facilities to upgrade and adopt modern practices that forego hazardous chemical use.

Although EPA decided to phase out sulfuryl fluoride use on food commodities in 2011, Dow AgroScience (the manufacturer of sulfuryl fluoride under the trade names Vikane and ProFume), along with others lobbied against efforts to phase out use, in the lead up to Congressional action to overrule the science on adverse health effects.

The U.S. Congress, in the 2014 Farm Bill (*Agricultural Act of 2014*), included a provision that requires EPA to ignore the science and law that establishes the safety threshold for exposure to fluoride. (See When Politics Trumps Science and Health Suffers.) The use of the pesticide sulfuryl fluoride, allowed in food production since 2004, in combination with fluoride use in water fluoridation, creates unacceptable hazards under EPA and National Academy of Sciences (NAS) scientific determinations. However, in an intervention that simply defies the scientific literature and thresholds for safety, the bill language orders EPA not to follow the law and science. The regulatory agencies responsible for protecting public health have identified elevated risk of dental fluorosis (breaking down of teeth enamel) in young children, and skeletal fluorosis (joint pain and muscle impairment), while the scientific literature raises serious issues of neurological and brain effects from elevated levels of fluoride.

If pesticide use and manufacturing are amplifying the impacts of the climate crisis, advocates argue that pesticide policy and regulation must address and eliminate chemical use. There are many viable alternatives to sulfuryl fluoride and methyl bromide fumigation.

The sulfuryl fluoride/GHG study represents an all too familiar pattern of widespread chemical use without proper knowledge of health and environmental effects before implementation. According to the most recent data by the California Department of Pesticide Regulations, sulfuryl fluoride is the 12th most used pesticide applied to sites across California, with over 2.9 million pounds used in 2018 for structural and agricultural pest control. Although sulfuryl fluoride emissions mainly stem from the greater Los Angeles area, researchers suggest other states, like Florida, may also produce emissions that remain unaccounted for by current National Oceanic and Atmospheric Administration (NOAA) chemical tracking. The California Air Resources Board (CARB) added sulfuryl fluoride to its list of "short-lived climate pollutants," being the only state to do so since 1990. However, California does not include sulfuryl fluoride in the list of GHG emissions to reduce by 2020 as researchers were not aware the chemical was a GHG until 2008. A 2009 study finds the termite insecticide to be a more potent GHG than carbon dioxide by up to 4,000 times over 100 years. Since sulfuryl fluoride has high global warming potential, it can remain in the atmosphere for more than 36 years.

Ninety-nine percent of structural fumigation treatments use sulfuryl fluoride. Recent work at the Massachusetts Institute of Technology (MIT) demonstrates that North America was the leading global source of sulfuryl fluoride emissions in 2019. The risk of multiple chemical contaminants in the atmosphere increases as global warming progresses. Melting glaciers can release persistent organic pollutants into waterways. Recently, pesticides and fertilizers overtook the fossil fuel industry in environmental sulfur emissions. Thus, health and environmental concerns will increase significantly, especially for individuals and ecosystems more vulnerable to the toxic effects of chemical exposure.

If pesticide use and manufacturing are amplifying the impacts of the climate crisis, advocates argue that pesticide policy and regulation must address and eliminate chemical use. There are many viable alternatives to sulfuryl fluoride and methyl bromide fumigation. These alternatives include temperature manipulation, atmospheric controls, biological controls, and less toxic chemical controls (diatomaceous earth). Many existing commodity storage facilities are too old and outdated to prevent pest infestation. This ineffectiveness leads to a reliance on toxic fumigation. Thus, a clean, regularly-maintained storage or processing facility can easily keep facilities pest-free.

As the climate crisis continues, banned and current-use pesticides put human and animal health at risk upon release into the atmosphere and waterways. Lack of adequate pesticide regulations highlights the need for better policies surrounding use. The European Union already bans sulfuryl fluoride from any food contact.

What to do: A switch from chemical-intensive agriculture to regenerative organic agriculture can significantly reduce the threat of the climate crisis by eliminating toxic, petroleum-based pesticide use, building soil health, and sequestering carbon. Current organic food production and handling do not permit conventional pesticide use, including fumigants like sulfuryl fluoride. Therefore, organic production reduces greenhouse gas emissions from chemical use. Learn more about how switching to organic management practices can mitigate the climate crisis by reading *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming*. For more information about organic food production, visit Beyond Pesticides' *Keeping Organic Strong* webpage. Learn more about the adverse effects chemical-intensive farming poses for various crops and how eating organic produce reduces pesticide exposure and benefits the environment.

SOURCE: Gaeta, D., Muhle, J., Vimont, I., Zhang, M., McKain, K., Crotwell, M., Miller, B., Miller, S. Greater Los Angeles Area dominates U.S. emissions of sulfuryl fluoride, a potent greenhouse gas. American Geophysical Union Fall Meeting. 2021; EOS

CHEMICAL NO-TILL CONTRIBUTES TO CLIMATE CRISIS | MAY 10, 2022

Chemical No-Till Failure Due to Herbicide Resistance Increases Greenhouse Gas Emissions

Widespread weed resistance on chemical corn and soybean farms is leading farmers to till their fields more often, significantly increasing greenhouse gas (GHG) emissions. These findings were published late last month in the journal *Nature Food* by a team of Iowa State University researchers. With agricultural practices accounting for roughly 10% of U.S. GHG emissions, and 25% of worldwide releases, farming practices that preserve soil health and sequester GHGs are essential for the future of food production.

Tillage is a farming practice that can provide a range of benefits for crop production, but only under the right conditions. A range of tillage practices exist, ranging from yearly conventional tillage, where most crop residue is plowed into the soil, to conservation tillage where some residue remains, and no-till systems where the soil remains covered. Repeated tillage causes significant harm to soil structure and biology, and results in erosion and the release

of GHGs like carbon dioxide, methane, and nitrous oxide from soil into the atmosphere. The harms of tillage have led both chemical and organic farmers toward no-till or reduced tillage systems.

Organic no-till farming, as practiced by farming groups like the Rodale Institute, employs the use of cover crops that are grown over the fall and winter and then matted down over the top of the soil using a machine called a roller-crimper. This process suffocates weeds and creates a rich mulch that can often be directly planted in. Some smaller scale organic farmers may till a single time, lay down cardboard or other weed suppressants, and then establish compost mulch beds in which crops can be grown.

From 1998 to 2008, corn and soy acreage under chemical no-till increased by over a combined 10 million hectares, roughly the size of Kentucky. This is associated with a reduction in tillage intensity during that time, which also reduces the GHGs emitted by tillage.

Chemical no-till, on the other hand, generally includes the use of herbicides sprayed directly over the top of plants to manage weeds competing with crops. This practice is reliant on genetically engineering row crops (specifically corn or soy) to be tolerant of a particular herbicide, or herbicide-tolerant (HT). Glyphosate-tolerant 'Roundup Ready' cropping systems have been the been the most popular over the last 25 years, providing chemical farmers a simple method of crop production without soil tillage.

Whatever gains this system provides in reducing atmospheric GHGs by reduced tillage is, according to researchers, eliminated by increases in tillage that have occurred since 2008, when weed resistance to glyphosate became widespread. To make this determination, researchers create a land-ecosystem model, use mapping data on environmental changes, and long-term farmer surveys to determine how the chemical no-till model came into widespread adoption and subsequently broke down. Corn-soybean cropping systems from the mid-1990s until the mid- 2010s are analyzed, with 2008 marking a shift in trends.

From 1998 to 2008, corn and soy acreage under chemical no-till increased by over a combined 10 million hectares, roughly the size of Kentucky. This is associated with a reduction in tillage intensity during that time, which also reduces the GHGs emitted by tillage. However, from 2009 to 2016, as glyphosate resistance spread rapidly across multiple different weeds, researchers found increases in GHG emissions from chemical farmers returning to tillage. Particular areas around the country, like the western corn belt in the Dakotas and Minnesota, represent some of the highest GHG emissions from returning to these practices.

"Our work implies that the benefit of HT crop adoption in reducing tillage has reached its peak, while the emerging weed resistance is found to contribute to intensifying tillage practices," the study reads. "As weed resistance persists and grows, tillage intensity is anticipated to continue to rise, which would further increase GHG emissions and contribute to global warming."

The shift from reduced tillage to increased tillage is a product of a cropping system that was always intended to provide short-term profits, rather than promote environmental sustainability. The study authors emphasize that farmer choices in managing herbicide resistance are critical in addressing the issue. But many farmers under contract with large agrichemical companies have a difficult time implementing alternative practices outside of a chemical cropping system. The pesticide/agrichemical industry is generally promoting new, more toxic herbicide products utilizing chemicals like glufosinate, dicamba, and 2,4-D to supplement glyphosate's diminishing returns.

This approach keeps farmers on a treadmill, delaying what is clearly inevitable, while contaminating food, surrounding soil and farmland, water, and air. "Without an effective strategy to control weeds, tillage intensity could continue to grow in the future and could undermine greenhouse gas mitigation achievements from other agricultural activities," said study author Chaoqun Lu, PhD in an Iowa State press release.

No-till organic addresses the failures of chemical no-till and has the potential to sequester carbon by retaining soil organic matter. Organic farms in general contain 13% more total soil organic carbon than conventional farms, as well as a higher level of the stable soil compounds fluvic and humic acid, a 2017 study found. According to calculations from the Rodale Institute in 2014, soil sequestration has the potential to store the greenhouse gas emissions of up to 52 gigatons of CO_2.

While the agrichemical industry continues to make arguments for chemical farming based primarily on the need for higher yields, this short-term, myopic focus loses sight of health and a sustainable future that humanity must create to continue life on earth. Research on organic agriculture shows it can provide quadruple the performance, synergizing financial, human health, ecological, and socio-economic well-being.

What to do: See Beyond Pesticides webpage on Organic Agriculture for more information and support organic food production with purchasing practices.

SOURCE: Lu, C., Yu, Z., Hennessy, D.A. *et al.* Emerging weed resistance increases tillage intensity and greenhouse gas emissions in the US corn–soybean cropping system. *Nat Food* 3, 266–274 (2022). https://doi.org/10.1038/s43016-022-00488-w; Iowa State press release

SULFURYL FLUORIDE, GREENHOUSE GAS, PETITIONED | NOVEMBER 3, 2022

California Petition Seeks Removal of Hazardous Fumigant Linked to Climate Crisis

In a fight against global warming, environmental groups Center for Biological Diversity (CBD) and Californians for Pesticide Reform (CPR) filed a formal legal petition in October 2022 urging the California Air Resources Board (CARB) to phase out the use of sulfuryl fluoride insecticides. This is not the first time sulfuryl fluoride has been petitioned for removal from the market. In 2006, Fluoride Action Network, Beyond Pesticides, and Environmental Working Group successfully petitioned the U.S. Environmental Protection, only to have EPA's decision overturned by Congress in the 2014 Farm Bill.

Sulfuryl fluoride is a fluoride compound with various adverse health effects, including cancer, endocrine disruption, neurotoxicity (reduced IQ), and reproductive damage. CARB added sulfuryl fluoride to its list of "short-lived climate pollutants," being the only state to do so since 1990. However, California does not include sulfuryl fluoride in the list of GHG emissions to reduce by 2020, as researchers were unaware the chemical was a greenhouse gas (GHG) until 2008. These termite and food use insecticides are 4,800 times more potent GHG than carbon dioxide at trapping carbon in the atmosphere. Furthermore, sulfuryl fluoride has high global warming potential and can remain in the atmosphere for more than 36 years.

The case of sulfuryl fluoride presents an all too familiar pattern of widespread chemical use without proper knowledge of health and environmental effects before adoption and a failure to take regulatory action on known hazards after allowed in commerce. Therefore, CBD's environmental health legal director Johnathan Evans, senior attorney, states, "Phasing out sulfuryl fluoride would provide the same climate benefits as taking one million cars off our roads every year… California's air regulators have a legal and moral obligation to reduce greenhouse gases that are helping to drive catastrophic global warming."

Sulfuryl fluoride, registered for termite and other wood-boring pest extermination in 1959, gained additional attention as a potential alternative to methyl bromide, a broad-spectrum insect fumigant. Ninety-nine percent of structural fumigation treatments use sulfuryl fluoride. However, researchers have identified concentrations of sulfuryl fluoride in the atmosphere due to the chemical's long half-life and greenhouse warming potential (GWP). Recent work at the Massachusetts Institute of Technology (MIT) demonstrates North America was the leading global source of sulfuryl fluoride emissions in 2019. The risk of multiple chemical contaminants in the atmosphere increases as global warming progresses. Melting glaciers can release persistent organic pollutants into waterways. Recently, pesticides and fertilizers overtook the fossil fuel industry in environmental

sulfur emissions. Thus, health and environmental concerns will increase significantly, especially for individuals and ecosystems more vulnerable to the toxic effects of chemical exposure.

In the 2022 report, "Termite Fumigation in California Is Fueling the Rise of a Rare Greenhouse Gas," researchers demonstrate that sulfuryl fluoride increases greenhouse gas (GHG) emissions. Although most sulfuryl fluoride emissions in the U.S. occur in California, most global emissions also occur in California. According to the most recent data from the California Department of Pesticide Regulations, sulfuryl fluoride is the 12th most used pesticide applied to sites across California, with over 2.9 million pounds used in 2018 for structural and agricultural pest control and over three million pounds used statewide in 2021. Although 50 to 60 percent of sulfuryl fluoride emissions occur in California, researchers suggest that other states, like Florida, may also produce emissions that remain unaccounted for by current National Oceanic and Atmospheric Administration (NOAA) chemical tracking.

Similar to this petition, Beyond Pesticides, and others maintain that without the phaseout of sulfuryl fluoride, there will be no incentive for grain storage facilities to upgrade and adopt modern practices that forego hazardous chemical use. In addition to the phaseout of sulfuryl fluoride, the petition also seeks to add this fumigant to California's greenhouse gas emission inventory for better monitoring.

The history of sulfuryl fluoride has pitted one chemical use against another, instead of incentivizing movement away from chemical dependency to viable alternative and organic management practices. For example, in 2011, the Natural Resources Defense Council (NRDC) sent a letter to EPA stating its opposition to EPA's phaseout of the toxic fumigant pesticide, which is marketed as a substitute for the outdated, ozone-depleting methyl bromide. EPA's action was in response to a 2006 petition cited above. According to its letter, NRDC believes that the "proposed action will imperil EPA's ability to complete the long-overdue phaseout of methyl bromide, leading to prolonged and increased depletion of the ozone layer, higher levels of ultraviolet radiation, and higher risks of cancer, cataracts, and immunological disorders." NRDC was objecting to EPA's announcement to cancel all allowable pesticide residue levels (tolerances) for sulfuryl fluoride over three years, effectively banning its use in January 2014.

The agency found that when residues on food products are combined with fluoridated drinking water and toothpaste, aggregate exposure levels are too high. Beyond Pesticides has repeatedly pointed to nontoxic practices that have eliminated the need for either hazardous fumigant throughout the petition process. Despite this, in 2014, buried in the *Agriculture Act of 2014* (the "Farm Bill"), Congress adopted an amendment at the behest of those seeking to keep sulfuryl fluoride on the market that prohibited EPA from moving against the chemical. For a more in-depth history on this, see When Politics Trumps Science and Health Suffers.

The current petition concludes, "Now that it is known and well-supported by science that sulfuryl fluoride is a highly potent greenhouse gas that can remain in the atmosphere for 36 years, and there are viable alternatives to the fumigant, Petitioners request that CARB 1) initiate a rulemaking to include sulfuryl fluoride in California's annual statewide greenhouse gas inventory pursuant to AB 32 and 2) initiate a rulemaking to phase out the use of sulfuryl fluoride."

As the climate emergency continues, banned and current-use pesticides put human and animal health at risk upon their release into the atmosphere and waterways. If pesticide use and manufacturing amplify the impacts of the climate crisis, advocates argue that pesticide policy and regulation must address and eliminate chemical use. There are many viable alternatives to sulfuryl fluoride and methyl bromide fumigation. These alternatives include temperature manipulation, atmospheric controls, biological controls, and less toxic chemical controls (diatomaceous earth). Many existing commodity storage facilities are too old and outdated to prevent pest infestation. This ineffectiveness leads to a reliance on toxic fumigation. Thus, a clean, regularly-maintained storage facility can keep facilities pest-free.

The European Union already bans sulfuryl fluoride from any food contact. Thus, switching from chemical-intensive agriculture to regenerative organic agriculture can significantly reduce the threat of the climate crisis by eliminating toxic, petroleum-based pesticide use, building soil health, and sequestering carbon. Current organic food production and handling do not permit conventional pesticide use, including fumigants like sulfuryl fluoride. Therefore, organic production reduces greenhouse gas emissions from chemical use.

What to do: Learn more about how switching to organic management practices can mitigate the climate crisis by reading *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming*. For more information about organic food production, visit Beyond Pesticides' *Keeping Organic Strong* webpage.

For more discussion, background, and strategy on fighting the climate crisis through the elimination of petrochemical pesticides and fertilizers, view Health, Biodiversity, and Climate: A Path for a Livable Future, the 2022 National Forum Climate Session, which will feature two speakers: Rachel Bezner Kerr, PhD, noted professor in Global Development at Cornell University (and Coordinating Lead Author for the United Nations Intergovernmental Panel on Climate Change report *Climate Change 2022: Impacts, Adaptation, and Vulnerability*); and Andrew Smith, PhD, chief operating officer at the Rodale Institute and coauthor of the report *Regenerative Organic Agriculture and Climate Change*.

SOURCE: Center for Biological Diversity, Californians for Pesticide Reform. Petition to Regulate Sulfuryl Fluoride To Reduce the Use of the High Global Warming Potential Pesticide. 2022; CBD Report

SOIL MANAGEMENT, CARBON SEQUESTRATION, ORGANIC

Listening to the Science on the Climate Crisis at All Levels–Federal, State, and Local

The undeniably grave climate crisis is evident to all. Increasingly, but not as urgently as advocates are advising, scientific understanding of the grave health and environmental effects are being incorporated into the deliberations on all policy decisions regarding petrochemical pesticide registrations and synthetic fertilizer use in agriculture and nonagricultural land management. The science, in this context, focuses on soil health—in particular, soil organic carbon, which sequesters atmospheric carbon and reduces its damaging atmospheric effects.

Although the soil is commonly recognized as a sink for atmospheric carbon, there is a false narrative that says carbon can be sequestered in the soil through chemical-intensive no-till agriculture. According to André Leu, international director at Regeneration International, "The main reason for the loss of soil carbon in farming systems is not tillage; it is synthetic nitrogen fertilizers. Research shows that there is a direct link between the application of synthetic nitrogenous fertilizers and a decline in soil carbon." Those same nitrogenous fertilizers act as potent greenhouse gases when volatilized.

The Rodale Institute's 40-Year Report (see page 169) on its "Farming Systems Trial" should end the myth of the toxic, petrochemical-based, GMO-herbicide, no-till systems. Rodale's scientific trials clearly show that these degenerative no-till systems are inferior to regenerative organic agriculture on every key criterion. The highest yields of corn are in the tilled organic manure system, and organic corn yields have been 31 percent higher than conventional/industrial farming systems in drought years. The trials show that herbicide no-till systems do not produce higher levels of soil organic carbon (SOC) than tillage systems, as the scientific literature finds.

Thus, chemical-intensive agriculture and nonagricultural land management contribute to climate change in multiple ways. Serious attention to combating climate change and mitigating its impacts requires all governmental bodies, at all levels of government, to consider climate impacts when making decisions. This means that the U.S. Environmental Protection Agency (EPA) must not approve registrations of pesticides that harm the soil or facilitate agricultural practices that interfere with carbon sequestration. It means that the U.S. Department of Agriculture (USDA), in a much more aggressive way, must lead the transition to organic agriculture as a replacement for chemical-intensive practices, ceasing all support for chemical-intensive agriculture immediately. It means that the Department of Interior (DOI) must manage all public lands with organic practices that ensure soil health and all that means for a livable future. It means that all lands managed by state and local governments transition to organic management practices.

POLICY

Decades of pesticide policy and "reforms" have increased society's dependency on toxic chemicals. The need for pesticides is assumed in law and regulatory review. The failure to regulate pesticides in a manner that incentivizes the marketplace to move to nontoxic and regenerative, organic practices results in crises that may be resolved in court after the damage is done—such as multi-million dollar court victories for cancer victims of glyphosate/Roundup exposure. However, the policies in place, as documented in this section, allow continued threats to pollinators and endangered species, hazardous exposure through pesticide drift, secret agency meetings with industry to recalculate risk levels, and more. Policy debates in Congress run the gamut, from advocacy to the phaseout of pesticides in National Wildlife Refuges to legislation that would further weaken existing pesticide law and take away local authority to adopt standards more restrictive than federal and state law.

PFAS AND REGULATORY FAILURE | FEBRUARY 18, 2022

PFAS Adds to the Legacy of Persistent Toxics Hurting Generations of People and the Environment

An analysis conducted by Safer States, and reported in *Environmental Health News* (EHN), concludes that in 2022 at least 32 states will consider 210 potential laws to ban or restrict one category of so-called "legacy" chemicals—the PFAS (per- and polyfluoroalkyl substances) family of compounds. "Legacy" or "forever" chemicals are those whose historical use, including many decades ago in some instances, has led to their toxic persistence in the environment and in organisms. In recent years, scientists, health and environment advocates, and policymakers have begun to recognize these as very serious contaminants and call attention to their ubiquity and impacts. Beyond Pesticides has identified multiple instances of such "legacies" (including those related to the production of pesticides and particularly, the infamous DDT), and will here discuss both PFAS, and concerns about such legacy chemicals as they may impact food producers.

The term "legacy" often connotes the ongoing influence or impact—generally salutary—of an individual's activity, or a set of principles or activity inherited from one's forebears. It is an apt description, minus the "salutary" part, for legacy chemicals—toxic "gifts that keep on giving" via persistent contamination of environments and bodies (human and other). In recent years, PFAS chemicals are increasingly being found in soil samples, in foods, in various kinds of water bodies and waterways, and in many drinking water sources. The environmental persistence of these compounds stems from the fact that they do not break down readily in the environment; hence, the "forever" moniker. Indeed, they accumulate in the human body (and no doubt in the bodies of other organisms, though that is less well studied) and are showing up many decades later in natural resources.

The highly toxic, fluorinated PFAS family of chemicals includes more than 9,000 compounds and two high-profile subcategories: PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid). PFAS compounds are associated, in humans, with occurrences of cancer (testicular, kidney, liver, and pancreatic), thyroid disease, high cholesterol, reproductive problems (pregnancy-induced hypertension, low birth weights, and decreased fertility), immune compromise, asthma, ulcerative colitis, developmental delays, and disruption of the endocrine system, which can have myriad systemic impacts.

PFAS are found in many industrial (aerospace, automotive, construction, electronics, and military) and consumer products, including personal care products and cosmetics, cleaning products, carpeting, cookware, stain- and water-resistant products (clothing, textiles, and furniture), firefighting foam, and food packaging, among others. Despite Congressional attempts to ban these compounds in consumer goods, their

inclusion in food packaging and processing equipment, electronics, some cookware, cosmetics, and other goods continues to be legal federally. (See more on states' responses, below.)

Historically, some of these compounds ended up as part of waste that was dumped after industrial and military uses. Perhaps not all misbehavior is historical: *The Guardian* has reported that the U.S. military very recently (2016–2020) incinerated more than 20 million pounds of PFAS foam next to environmental justice communities. This occurred despite the lack of any evidence that incineration destroys the PFAS compounds; indeed, burning it discharges these toxic chemicals "into the air and onto nearby communities, farms, and waterways." These legacy industrial and consumer chemicals are currently released into the environment via such products and the waste stream. Human exposure to them happens primarily through personal use of PFAS-contaminated products, through consumption of contaminated water or food, or via occupational exposures.

Estimates put the number of people in the U.S. exposed to these chemicals via drinking water between 110 and 200 million. The Environmental Working Group (EWG) offers a PFAS map of the U.S. that shows just how pervasive the problem is. Areas with widespread PFAS contamination of drinking water include large swaths of the Northeast (especially Massachusetts, Rhode Island, southeast New Hampshire, eastern Pennsylvania, Long Island, New Jersey, and Delaware), as well as significant portions of Michigan, Ohio, Illinois, Kentucky, North and South Carolina, Alabama, Florida, Colorado, and California. Beyond those, the map represents military (and other) sites of PFAS contamination unrelated to drinking water.

There has been precious little activity at the federal level to deal with PFAS (and some other legacy chemicals.) The U.S. Environmental Protection Agency (EPA) announced in 2019 that a "Comprehensive Nationwide PFAS Action Plan" would be forthcoming. Since 1998, EWG notes, "despite mounting evidence of PFAS' toxicity and contamination, EPA has inexcusably dragged its feet. The [agency] has failed to set a legal limit for any PFAS in tap water, and its unenforceable health advisory level for PFOA and PFOS is 70 times higher than what independent studies show is needed. In 2019, EPA announced a toothless 'action plan' that would do nothing to reduce ongoing PFAS releases or clean up legacy PFAS pollution."

PFAS are found in many industrial (aerospace, automotive, construction, electronics, and military) and consumer products, including personal care products and cosmetics, cleaning products, carpeting, cookware, stain- and water-resistant products (clothing, textiles, and furniture), firefighting foam, and food packaging, among others.

One small example of such negligence: at the very end of the Trump administration, the agency issued confirmation that high-density polyethylene (HDPE) containers used to store and transport pesticides are commonly treated with fluorine compounds to reduce risk of changes in chemical composition of the pesticides. Such treatment meant that the pesticide containers likely leached PFAS compounds into the pesticides, representing a potential and significant source of PFAS exposure throughout the country's conventional agriculture sector.

Another is the 2020 discovery that an EPA registered mosquito pesticide, Anvil 10+10, contained PFAS compounds—thus exposing the public broadly when and wherever it was deployed. Beyond Pesticides Community Resource and Policy Director Drew Toher commented, "This is an issue that cuts to the core of what's wrong with our federal system for regulating pesticides. The finding makes it imperative that EPA review and disclose full pesticide formulations before allowing the public to be exposed to unknown hazards."

With the advent of the Biden administration, there has been more effort to address the problem. In the Fall of 2021, EPA Administrator Michael S. Regan announced an EPA PFAS Strategic Roadmap that purports to lay out a whole-of-agency approach to addressing PFAS. The EPA website notes, "The roadmap sets timelines by which EPA plans to take specific actions and commits to bolder new policies to safeguard public health, protect the environment, and hold polluters accountable. The actions described in the PFAS Roadmap each represent important and meaningful steps to safeguard communities from PFAS contamination. Cumulatively, these actions will build upon one another and lead to more enduring and protective solutions."

For states and localities, who are on the front lines of PFAS contamination, this is welcome news *and* significantly tardy. Absent much protective action on forever chemicals at the federal level, including on persistent pesticides, states have been stepping up, particularly in the past five years or so, to deal with a problem that permeates many aspects of people's lives.

The Safer States analysis sets out these particulars:

- At least 19 states will consider regulation of PFAS, such as restricting use when such use is avoidable, requiring disclosure of PFAS when present in consumer goods, or restricting use in specific categories (e.g., cosmetics, textiles, and food packaging). AK, CA, CO, HI, IA, IL, MA, MD, MI, MN, NH, NC, NJ, NY, PA, RI, VT, WA, WI
- At least 17 states will consider policies on PFAS cleanup, management, and accountability, such as designating the chemicals as hazardous, restricting their disposal, or allocating resources toward cleanup. AK, CA, FL, IL, IN, MA, ME, MD, MI, MN, NH, NC, OK, RI, VT, WA, and WI
- At least 19 states will consider legislation related to contamination

of drinking water, groundwater, or soil with PFAS. AK, AZ, CT, FL, IA, IN, KY, ME, MN, NC, NH, NY, OH, RI, SC, VA, VT, WV, WI
- At least three states will consider banning PFAS in products labeled as recyclable. HI, MD, NJ
- At least six states will consider policies to strengthen existing safe-chemical policies for cosmetics or children's products. CA, MA, MI, NY, VT, and WA

According to EHN, Safer States National Director Sarah Doll commented: "State legislatures recognize the severity of the toxic PFAS crisis we're facing and they're taking action.... [They] continue to lead the way in addressing these serious problems with urgency and innovative solutions." Michigan State Senator Winnie Brinks issued a statement saying, "In Michigan, PFAS and other 'forever chemicals' have impacted my community for decades. We've made significant strides in assessing the scope of the problem statewide and filtering PFAS out of drinking water."

Not only is the public exposed to such chemicals; those who work in factories that create products that include PFAS, or workers who use such products regularly, have higher exposures. Safer Chemicals, Healthy Families noted in 2021, "Firefighting foams without PFAS are already used successfully around the world, but outdated federal guidelines have kept foams containing PFAS in use for training and firefighting at U.S. commercial and military airports." Across multiple states, firefighters have begun to bring lawsuits against manufacturers of the foams, charging that the companies knowingly made and sold products with these forever chemicals that put the workers' health at risk. Others who may be at greater-than-average exposure risk include pregnant or lactating people, and young children.

PFAS compounds are not the only ones that exhibit extreme persistence in the environment and accumulation in bodies. Some legacy pesticides, and notoriously DDT (dichlorodiphenyltrichloroethane) and its breakdown metabolite DDE (dichlorodiphenyldichloroethylene), are incredibly persistent in the environment. The insecticide DDT was banned in 1972, yet its impacts continue. Its primary metabolite, DDE, shows up in produce grown in soils that were treated—even decades ago.

Not only is the public exposed to such chemicals; those who work in factories that create products that include PFAS, or workers who use such products regularly, have higher exposures.

Beyond Pesticides recently wrote about the Pesticide Data Program Annual Summary (conducted by the U.S. Department of Agriculture), which showed once again that residues of a number of legacy pesticides—including DDT and DDE—continue to be present in foods. (DDT and DDE were particularly present in collards, broccoli, carrots, radishes, and winter squash.) Beyond Pesticides has written about the ongoing impacts of legacy DDT/DDE exposure here, here, and here. It has reported on the impacts of POPs (Persistent Organic Pollutants), such as legacy and banned pesticides, on animals. Legacy impacts also show up, for example, as contamination of former fruit orchards that were treated with lead arsenate pesticides as much as 70 years ago.

Certainly, pesticides are found broadly in soils, as reported here and here. But the ongoing detection of PFAS in various environments and soils is now threatening the ability of growers, including organic growers, to produce food that does not harbor these compounds. This contamination often occurs via the spreading of biosolids fertilizer (aka "biosludge" or sewage sludge), sometimes referred to as compost. (Compost under federal organic law cannot contain biosolids.) This is how that happens: PFAS compounds are discharged in wastewater and solid waste (from consumer and other products), and move the problem "downstream," such that these chemicals inhabit biosolid fertilizers. These products are then sold and spread on agricultural land, contaminating local ground and surface waters, as well as animals that graze on such land and plants that are grown in the contaminated soils.

Environmental Health News reported in 2019 on this growing problem in Pennsylvania; PFAS showed up in the Maine dairy and livestock sector in 2016. The issue, as reported by *ECORI News*, has migrated to the general consumer sector, as wastewater treatment operations are barely treating biosolids, and then repackaging the contaminated (with PFAS, pesticides, pharmaceuticals, and more) material as home fertilizer and compost.

A prime and very recent example of this biosolids problem in agriculture is that of a diversified crop operation, Songbird Farm in Unity, Maine. Farmers Adam Nordell and Johanna Davis, growers of Certified Organic grains and vegetables, recently learned that their fields are victims to such legacy PFAS contamination. They write in their website statement about the matter: "We were just blindsided to learn that our home farm and primary lease field were licensed for the spreading of biosolids in the early 1990s, (24 years before we purchased our farm and moved to Unity). Biosolids have been in the news recently for their correlation with PFAS chemical contamination. We hired a private soil scientist to sample and test our well water, and soil and produce. All three tests came back positive [for PFAS]. Our well water read at 400 times the state's recommended threshhold. The results are preliminary and need to be cross-checked, but we feel it is critical that we stop our sales and have requested that our retail outlets pull our products from their shelves for now. This is not a product recall. This is a precautionary product pause while we gather more info."

This family's livelihood, and their investment of dollars and sweat and

heart, are all on the line. Part of the farmers' statement to their consumers contains this telling paragraph: "I can't tell you how heart wrenching this is for us learn and now to communicate. In a world where we can all buy conventional produce and out of state organic vegetables and grains at a cheaper price any day of the week, the one currency we have as local organic growers is our transparency and the trust of our customers." They note that although Maine has no guidelines on acceptable levels of PFAS in vegetables, the state's Center for Disease Control & Prevention has already begun work on establishing specific produce guidelines.

This situation exemplifies how "live" this PFAS issue is, and how behind the eight ball governments often are in contending with these emerging contaminants. The negligence and/or slow pace of EPA, FDA (the U.S. Food and Drug Administration), and Congress in addressing the PFAS problem has spurred many states to step in and up to do so themselves as this tranche of legislation reported on by Safer States illustrates.

What to do: These most-recent PFAS discoveries, and state legislative efforts to deal with them, underscore not only the federal failures, but also, the urgency and gravity of realigning federal and state agencies so that precaution becomes the guiding watchword. Legacy/forever chemical contamination is a dramatic demonstration of how the historical, non-precautionary ethic in the U.S. can cause egregious harm—even years and decades hence. Government regulation should, at the very least, stop making the problem worse through continued permitting of the use of PFAS compounds and toxic pesticides.

SOURCE: Marusic, K. "States will weigh more than 210 bills on toxic "forever chemicals" in 2022. *Environmental Health News*. February 2022.

ORGANOPHOSPHATE'S CONTINUED USE ALLOWED | MARCH 11, 2022

Despite Past Findings of Insecticide's Threat to 1,284 Species, EPA Reverses and Allows Continued Use

With a history of unenforceable and impractical pesticide label restrictions resulting in U.S. Environmental Protection Agency (EPA) findings of ludicrously small or no risk, the agency is at it again with its latest announcement that allows the continued use of the deadly organophosphate insecticide malathion. This just the latest example of what advocates see as an irresponsible federal agency falling far short, as the nation and world sit on the brink of biodiversity collapse and deadly pesticide-induced diseases.

In a head-spinning development, the U.S. Fish and Wildlife Service (FWS) announced on March 8 its final Biological Opinion (BiOp) on malathion, which claims that the commonly used insecticide poses no extinction risk to any protected animal or plant. The FWS

review and BiOp are part of EPA's evaluation of whether malathion—an organophosphate insecticide that causes serious damage to many organisms—should retain its registration. The Executive Summary of the BiOp concludes: "Our findings suggest that no proposed species or candidate species would experience species-level effects from the action [i.e., registration and thus, permitted use of malathion], and, therefore, are not likely to be jeopardized. We also conclude the proposed action is not likely to destroy or adversely modify any proposed critical habitats." Advocates view this BiOp as a terrible setback for biodiversity and wildlife, including pollinators, aquatic organisms, and birds, and for fragile ecosystems.

More than a million pounds of malathion are used annually in the U.S. on cotton, corn, and other crops; as of 2018, another two million pounds was also in use for home gardens, miscellaneous purposes, and mosquito control. Pest management entities, whether private companies, states, or localities, deploy malathion for adulticiding of mosquitoes—a notoriously ineffective strategy that uses spray trucks in the hope of "knocking down" mosquitoes that happen to be in the immediate area at a given moment.

Malathion spray, whether for mosquitoes or on crops, can travel and impact a wide area, exposing nontarget organisms and humans alike. In humans, malathion exposure is linked with reproductive, endocrine, neurological, hepatic, renal, and developmental harms. Its terrible impacts on wildlife are well-documented. Further, as Beyond Pesticides covered in February 2022, widespread, intensive pesticide use for mosquito control has catalyzed development of resistance to those same pesticides in some mosquito populations—an inevitable outcome of chemical treatment of pests. A shift to alternative strategies is overdue.

The history of EPA and malathion is fraught. In 2017, after an EPA finding that use of organophosphate insecticides has negative impacts on more than 1,000 endangered and threatened species—and that malathion, specifically, threatens 1,284 species—Dow Chemical pressured the Trump administration to ignore the studies that underlay that finding. Later that year, the administration sought a two-year delay in EPA's review of malathion. In 2019, the Center for Biological Diversity (CBD) discovered documents that showed that the Trump administration had this information on the harms to species in 2017 and suppressed it. Indeed, top officials at the Department of the Interior, including Acting Secretary David Bernhardt, knew of and stopped the release of a FWS BiOp that showed the extent of the dangers of this class of pesticides.

According to the *Associated Press*, "[FWS] officials now say malathion could cause limited harm to hundreds of species, but is unlikely to jeopardize any of them with extinction as long as labels that dictate its use are changed," but advocates insist that proposed changes to labels would do little to protect species that in some cases have dwindled to very few individuals." In addition, this "no extinction" claim, even if borne out, would depend utterly on the voluntary compliance of farmers, pesticide applicators, and consumers to use the insecticide exactly according to label instructions—which will not even be developed for another 18 months. According to advocates, this BiOp represents an unacceptable gamble with endangered ecosystems and organisms.

The FWS opinion contradicts the agency's 2021 BiOp (no longer available on the EPA website), which asserts that, due to registration and use of the insecticide, "78 listed species could be jeopardized, and 23 critical habitats could be adversely modified by the use of malathion." This final, 2022 BiOp also contradicts the agency's 2017 conclusion "that 1,284 species would likely be jeopardized by malathion." According to the Center for Biological Diversity, both that 2021 assertion and this final BiOp used "debunked Trump-era methodology promoted by the pesticide industry" as the bases for the opinion.

Only a week prior to the March 8 release of the final BiOp, FWS's coequal agency, the National Marine Fisheries Service (NMFS), issued an updated draft BiOp, which concludes in part: "For malathion, we present draft conclusions that EPA's action is likely to jeopardize the continued existence of 37 species, and likely to destroy or adversely modify critical habitat for 36 species." It also asserts that malathion (and two notorious cousin organophosphate pesticides) threaten nearly every endangered salmon, sturgeon, and steelhead species in the U.S.

More than a million pounds of malathion are used annually in the U.S. on cotton, corn, and other crops; as of 2018, another two million pounds were also in use for home gardens, miscellaneous purposes, and mosquito control.

CBD notes that this NMFS BiOp "debunks the Trump methodology that based harm analyses on historic use data known to be incomplete and unreliable.... Yet the Fish and Wildlife Service continued to heavily rely on the same historic use data in its analyses to reach conclusions that the pesticide would not harm endangered species." CBD also writes, "The widely disparate findings by the two agencies were highlighted in harm assessments for bull trout and salmon, biologically similar species that share habitat in the Pacific Northwest. [FWS says] that malathion won't harm bull trout in Pacific Northwest streams; meanwhile [NMFS] has concluded that the use of the very same chemical in the very same streams is pushing every Pacific salmon to extinction." CBD's environmental health director, Lori Ann Burd, commented: "One's based on sound science, and one's based on industry-driven politics. [NMFS] is bravely taking a stand to prevent extinctions while [FWS] is continuing to cower to an anti-science, anti-endangered species agenda."

EPA struck a cheerier note in its press release on the BiOp with the headline, "EPA Takes Steps to Protect Endangered and Threatened Species from Insecticide." And FWS's assistant director for ecological services, Gary Frazer, frames the BiOp differently, saying that despite the 2021 BiOp, FWS "worked with EPA, the malathion registrants and USDA to develop general and species-specific conservation measures that significantly reduce many of the effects of malathion use on listed species and their critical habitats."

FWS insists that implementation of new conservation measures—changes in the text on the pesticide's label, reductions in the maximum number of allowable applications per year, establishment of buffers from aquatic habitats, and restrictions from application when rain is forecast or when certain crops are in bloom—will eliminate "the problems identified earlier." EPA has said it will provide online details for protocols that users of malathion should follow, such as no-spray zones in areas of critical wildlife habitat. But many of these have been designated as voluntary "guidelines," rather than compulsory rules.

CBD has decried this final BiOp; Beyond Pesticides joins in this response to EPA's shocking avoidance of the scientific evidence on malathion. CBD's Brett Hartl commented, "This is an enormous punt. There's not a single endangered species that will see anything change on the ground because of this biological opinion for at least 18 months, but probably never."

CBD's Lori Ann Burd issued this statement: "The Biden administration has squandered a[n] historic opportunity to rein in the dangerous use of one of the world's worst neurotoxic pesticides. By ignoring the best available science and choosing to rely on unenforceable promises of good behavior by the pesticide makers rather than real, on-the-ground conservation measures, the Biden administration is condemning wildlife to extinction with a wink and a nod. This decision to cave to powerful special interest groups will do far-reaching harm to our most endangered wildlife."

What to do: Take action to ban malathion in your community and to learn more about impacts of malathion and other pesticides on biodiverse and functional organisms, wildlife, and ecosystems, see the work of the Center for Biological Diversity, and Beyond Pesticides' coverage: Mosquito Control and Pollinator Health, The Truth About Mosquitoes, The Health Effects of Pesticides Used for Mosquito Control, Pesticide Use Harming Key Species Ripples through the Ecosystem, and its Daily News Blog archives on malathion.

SOURCES: Brown, Matthew, "US officials reverse course on pesticide's harm to wildlife." AP News. March 8, 2022; CBD press release, March 8

EXPOSURE: PESTICIDE DRIFT | MARCH 18, 2022

Pesticide Drift or Chemical Trespass Continue Uncontrolled, Despite Successful Litigation

A 2020 lawsuit related to pesticide drift was resolved on March 8, 2022 in San Joaquin (California) Superior Court with a finding that Alpine Helicopter Services, which specializes in pesticide applications for government and tourism entities, had violated pesticide drift laws and endangered public health and safety. The court further found Alpine liable for damages related to its actions, though penalties in the case, brought by California state prosecutors and the California Department of Pesticide Regulation (DPR), have yet to be determined. The case exposes a handful of the many instances of pesticide drift, also known as "chemical trespass," that occur every year in the U.S. In 2004, Beyond Pesticides covered the issue with *Getting the Drift on Chemical Trespass*; its monitoring of drift issues is ongoing, as can be seen in its "Pesticide Drift" archives. The long history of nontarget exposure, contamination, and poisoning teaches that drift is a function of pesticide use, but not considered adequately by regulators who allow the marketing of poisons that are known to move through the environment uncontrolled. Cases like the Alpine case highlight a relentless problem associated with the daily use of pesticides.

Pesticide drift is any airborne movement of pesticides from the target application site to any unintended area; pesticides can drift, according to multiple studies, for as much as several miles.

Pesticide drift is any airborne movement of pesticides from the target application site to any unintended area; pesticides can drift, according to multiple studies, for as much as several miles. Drifting pesticides might be apparent as a cloud of droplets or vapor, as "dust" particles during application, or as a noxious odor that lingers after application. However, drift can also have no odor, be invisible, and persist for days. Drift can happen whether the application is via aerial or ground spraying, as well as from applications that volatize and move through air currents, exposing people, animals, crops, trees,

and non-crop plants to the toxic chemical compounds—most typically, insecticides, herbicides, and/or fungicides. In addition, soil and water resources can become contaminated, as well as the very air that people and animals are breathing.

Pesticide drift can cause acute poisoning and/or chronic health impacts in farmworkers or anyone in the application area or working in nearby fields being treated. Included among those at high risk from drift are families of farmworkers who live near agricultural parcels. Yet, as in this subject litigation, it also happens in other settings. Schools, playground, recreational fields, and other facilities at which children are frequent visitors, have been affected by pesticide drift, which is all the more concerning because children have elevated vulnerability to chemicals, given their sizes and developmental stages.

This litigation charged Alpine with pesticide applications in four "spray drift," or "chemical trespass" incidents. Three of those were in San Joaquin County; one was at a school (in 2017), another at a sports complex (2019), a third saw herbicides applied to nearly 5,000 acres of land, resulting in massive crop losses (2014), and a fourth occurred on a residential yard (2020). That sports complex was the San Joaquin County Regional Sports Complex in Stockton, a facility that serves people of color communities that already experience disproportionate exposure to, and impacts of, environmental pollution.

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California officials registered their takes on the suit and the decision: DPR acting chief deputy director, Karen Morrison, commented, "The blatantly careless actions of Alpine threaten the health and safety of children and communities." California Attorney General Bob Bonta commented, "Today's decision is an important win for the many in our state who live and work in agricultural communities. Alpine's careless approach to pesticide application is unacceptable." According to Agri-Pulse, he also said that the decision ought to send a powerful message to agricultural enterprises that the state "will hold them accountable if they violate the law when using 'toxic chemicals.'"

In 2018, the California DPR published its *Pesticide Drift: Pocket Guide* as a primer on pesticide drift, geared to the general public and those who may have experienced or witnessed this kind of chemical trespass. It notes that in California, not all drift is illegal, but that "Pesticide laws focus on spray drift that causes harm, or has the potential to do so. The law specifically recognizes that pesticides may drift but says that 'substantial' drift is not allowed. The law prohibits applications if there is a reasonable possibility of harm to people or property." Pesticide Action Network North America (PANNA) created something similar in 2017: *In Case of Drift:* A Toolkit for Responding to Pesticide Drift. It had issued the 2004 report titled *Chemical Trespass:* Pesticides in Our Bodies and Corporate Accountability.

A sense of the scale of pesticide applications—not all of which result in drift—can be gleaned from the Environmental Working Group's (EWG) coverage of just one California county's experience. Of course, Ventura County

hosts a lot of agricultural activity, so is not representative of all U.S. counties. But EWG research found that, from 2015 through 2020, roughly 963 acres were sprayed with more than 9.1 million pounds of pesticides—an average of more than 1.5 million pounds annually. This chemical intensity happened in *just one county*.

Some pesticides are far more prone than others to drift: the herbicide dicamba has been the poster child for this scourge. It is extremely prone to drift in warm temperatures, and even more so, when it is mixed with glyphosate, another notorious herbicide. Dicamba, alone or paired with glyphosate, has been responsible for massive levels of damage to non–genetically modified crops (and other plants) that have no protection against the compound. As damage from dicamba has mounted, farmers have litigated left and right, legislators in the states have taken up measures to try to control the application (and therefore, the damage), and manufacturers are scrambling to keep the compound "palatable" to farmers. See more on dicamba here and here.

In a Beyond Pesticides' 2021 National Pesticide Forum session titled "Fighting Chemical Trespass," several victims of the phenomenon spoke about their experiences of damage to their farms, crops, livelihoods, and bodies. All of the participants suffered unwanted aerial spraying of their properties, and subsequent, lingering drift of the chemicals. (In one instance, inspectors found that pesticide residue levels were even higher seven days after the incident than at two days out, likely due to pesticide compounds that had landed on surfaces and then volatilized into the air.)

Two participants are organic farmers who could not sell their then-contaminated crops as organic, and one of them could not sell them at all because the compounds that were sprayed are illegal for use on food crops. That same farmer, who was formerly in robust health, has had massive chronic health consequences, is now legally disabled, and has acquired $100,000 in medical debt as a result of the chemical poisoning she endured across multiple incidents.

One of the farmers summarized that, as an organic producer, he has huge concerns about such chemical trespass—for the safety of the food he produces, for farmworker safety and health, for the health and integrity of pollinators and other organisms, and the surrounding environment, and of course, economic issues of lost production and income. Towering over the immediate financial concerns is that, once contaminated, a USDA (U.S. Department of Agriculture) certified organic farm (or at least the affected parts) must exit the certification program for three years—a huge blow to a modest organic operation.

That same farmer contends that reform of drift policy at the state level—currently a kaleidoscope of varying, or no, regulations—is critical. He also suggests that organic farmers, in particular, secure personal liability insurance for any health/medical debt they might incur as the result of a drift or spray incident. Another farmer notes that there is a huge need for medical toxicology experts who can assist victims in the often-years-long process of discovery and documentation of evidence of the harms of the trespass incidents.

Most instances of chemical trespass are never litigated. When they have been, outcomes have been mixed, as evidenced here, here, here, and here. One of the real slogs for victims of drift is that the onus for proving what happened is entirely on them: getting inspectors out immediately, and subsequently, to validate and attach metrics to the damage, quantifying ongoing economic, health, and environmental damage, and more. Most people find these prospects entirely too daunting and expensive, and applicators and manufacturers are, thus, rarely held accountable.

The herbicide dicamba has been the poster child for drift. It is extremely prone to drift in warm temperatures, and even more so, when it is mixed with glyphosate, another notorious herbicide.

The U.S. Environmental Protection Agency (EPA) addresses the drift issue on its website, and assures the public that it "evaluate[s] potential for drift as a routine part of [its] pesticide risk assessments and [is] using new approaches for estimating drift impacts on communities living near fields where crops are grown, farmworkers, water sources, and the environment." Beyond Pesticides Executive Director Jay Feldman notes, "It is rare, however, that EPA factors drift into its calculation of harm associated with pesticide use, and it is just as rare for those whose pesticide applications drift to be held accountable for the harm (short- and long-term) it causes."

That same EPA web page also says the quiet part out loud: "As we assess new pesticides and reevaluate older pesticides, we evaluate the potential for each pesticide to drift and strengthen labeling as needed." Advocates say "strengthening labeling as needed" is a feeble solution to the problem. Indeed, the many lawsuits that attempt to hold applicators responsible for health, crop, and environmental harms caused by pesticide drift—and the far, far greater number of incidents that never get reported or litigated—do not tend to happen because the labeling on the pesticide containers is not quite "strong" enough. They more often happen because, as in this subject lawsuit, human negligence, indifference, or error—and the profit motive—are at work.

The nonprofit Community Environmental Legal Defense Fund (CELDF) describes the systemic situation well: "The Environmental Protection Agency, or EPA, is an appointed government agency that is charged with 'protecting' people and the environment. But instead, it operates more as an agency that regulates how much harm can occur before government action is required. The requirements of EPA testing,

especially its lack of preventive measures, are alarming. In order to require testing of a new chemical, EPA must first show the potential risk. No evidence of harm is interpreted as no harm, from their perspective. The problem with this way of thinking is that many of the harmful effects of chemical trespass are worsened through prolonged exposure and are often not immediately seen in testing. It's a system designed to let corporations put toxins in our environment with no repercussions to them—but serious repercussions for people, communities, and nature."

What to do: One genuine fix for the problem would be to deregister pesticides, such as dicamba, that are prone to drift. (Such action would be far more possible did industry not exert undue influence over EPA.) Another welcome development, surely, would be more and improved legal, medical, forensic, and technical supports for those who are exposed to chemical trespass (whether through drift or application to non-targets), at the federal and state levels. Beyond Pesticides, recognizing how vulnerable organic farms can be to impacts of these chemical trespass incidents, might recommend that USDA's National Organic Program consider the issue of supports for organic farms in this unhappy "trespassed" circumstance. Ultimately, EPA must acknowledge the commonplace fact of drift and calculate the resulting exposure pattern and harm to people and property. If drift effects are fully calculated for their adverse impact, the "reasonableness" standard of allowable harm under EPA assessments is quickly exceeded. In this context, toxic pesticide use is unacceptable, especially given the availability and economic viability of organic practices. Support organic by purchasing organic food and adopting and advocating for organic land management.

SOURCE: People of the State of California v. Alpine Helicopter Service, Inc., Superior Court of the State of California, County of San Joaquin. STK-CV-UEJ-2016-4746, consolidated with STK-CV-UBT-2020-7717; STK-CV-UCC-2020-9229. February 23, 2022. 2020; Franco, Victoria, "Helicopter Company Found Liable For Illegal Pesticide Drift." SFGATE, March 8, 2022.

"In a previous study in California that primarily looked at milkweed in agriculture and urban interfaces, we had looked at a small number of plants from retail nurseries, and found that they contained pesticides," study co-author Matt Forister, PhD, said.

"So we were prepared for this much larger sacover contamination, but it was surprising mple of nursery plants to again unto see the great diversity of pesticides found in these plants.

INDUSTRY INFLUENCE AT UN CHALLENGED | DECEMBER 22, 2022

Groups Again Call for Urgent Action to Eliminate Pesticide Industry's Influence at the United Nations

International health and environmental groups submitted an urgent letter to the United Nations Food and Agriculture Organization (FAO) late last month demanding "greater transparency and accountability" through termination of the agency's two-year-old partnership with CropLife International (CLI), a global trade association representing the world's biggest pesticide manufacturers. Addressed to FAO Deputy Director Beth Bechdol ahead of FAO Council 171 session in Rome and COP15, the letter outlines a unique opportunity for the organization to lead the phaseout of fossil-fuel-based food systems and use of agrochemicals while upholding the agency's responsibility to act in response to conflicts of interest and human rights violations.

The original Letter of Intent (LOI), signed between CLI President and CEO Guilia Di Tommaso and FAO Director-General Qu Dongyu in October 2020, framed the partnership as a means to ensure humanity's freedom from hunger while advancing Sustainable Development Goals. However, according to Pesticide Action Network (PAN) Europe Policy Officer Manon Rouby, "While the private sector has been working with FAO for years, this official agreement with CropLife directly threatens FAO's work on supporting farmers in the transition towards agroecology, while reducing the harms of synthetic pesticides worldwide. With CropLife members being the largest agrichemical companies in the world, this association is unacceptable and a direct threat to human rights. We once again urge the FAO to rescind this agreement."

According to the original letter's coauthors, 200,000 individuals from over 107 countries, from 430 civil society and Indigenous Peoples organizations, nearly 300 academics and scientists, and nearly 50 philanthropic groups, as well as the Special Rapporteur on the Right to Food, raised concerns in a report addressed in the 49th session of the UN Human Rights Council. While the backlash prevented the LOI from moving forward into a more formal Memorandum of Understanding earlier this year, as of today's publication, the agreement remains in place without a set expiration date, fundamentally undermining the agency's support for alternatives to generate ecologically-based agrifood systems without toxic pesticides.

With 11 subsidiary national associations and six member companies (BASF, Bayer, Corteva, FMC, Sumitomo Chemical, and Syngenta), CLI has a vested interest in maintaining the status quo. While claiming to champion the role of agricultural innovation in crop protection to advance sustainable agriculture, instead, the pesticide industry is leveraging "agricultural innovation

and digital technology" to expand market opportunities and increase profits in the Global South. Private sector investments are actively being facilitated through the FAO's Hand-In-Hand Initiative; for example, in October 2020, the Director General actively appealed to CropLife for investments in low- and middle-income countries in his speech to the CLI Board of Directors.

While CLI has not made any direct financial contributions to FAO since 2011, member companies outsized political and economic influence on pesticide-related policies, alongside global export and distribution, is bearing fruit in lucrative markets like Nigeria. Between 2015 and 2019, the country's National Agency for Food and Drug Administration and Control (NAFDAC) registered approximately 822 pesticides, of which 63% are classified as highly hazardous pesticides (HHPs), with glyphosate holding the highest share of imports (67.4 and 53.4 percent in kilograms and liters, respectively). Across all 46 countries in sub-Saharan Africa, FAO estimates that the use of pesticides increased by 150% between 2006 and 2019, attaining over 100,000 tons per year. In addition to highly hazardous pesticide (HHP) sales being higher in the region, exponential impacts on health and environment reveal a vulnerability exploited by the partnership in the Global South. According to a survey by the Small-Scale Women Farmers Organization of Nigeria and Alliance for Action on Pesticides (AAPN) in Nigeria, 80 percent of pesticides used by women in four Northern Central states (Nasarawa, Benue, Plateau, and Abuja) are highly toxic to humans and require additional regulation.

While the increased level of use has resulted in negative health, environmental and economic consequences in-country and around the world, FAO continues to expand private partnerships in hosting regional workshops this year on the "proper management of pesticides" in the Middle East and North Africa region, with over a dozen countries participating in Jordan despite obstacles to implementation, such as insufficient staffing, lack of an adequate registration system, limited expertise, lack of risk assessment measures, and limited access to information.

Considering these negative impacts surrounding CSI's expanding sphere of influence, the group's urgent letter strongly urges FAO to prevent CLI and its member companies from attaining permanent observer status, as such a move would "further the conflict of interest that exists between CLI and FAO, grant even greater privileges to the pesticide industry, and blur the areas of collaboration that already lack transparency." Following the precedent pioneered by UN Women, which ends its Memorandum of Understanding with investment firm BlackRock after receiving feedback from civil society, FAO has reached a turning point.

As an original signatory to the PAN UK June 9th letter, Beyond Pesticides echoes PAN UK in that it is imperative to "prioritize people-led agroecology as an innovative climate resilience solution and ensure that climate and science strategies do not give precedence to pesticide and fertilizer products, nor private sector entities affiliated with human rights violations or environmental destruction." CSI's fundamental objective is the maximizing of toxic pesticide sales and runs counter to reducing reliance. As Beyond Pesticides has constantly reiterated that "sustainable" pesticide use or incremental reductions will not prevent a variety of downstream

impacts and existential crises. Pesticides are damaging pollinator populations, adding to the human chemical body burden, catalyzing disease processes, launching trophic cascades, degrading agricultural soils, and so much more.

What to do: As FAO aims to "achieve food security for all and make sure that people have regular access to enough high-quality food to lead active, healthy lives," truly sustainable, organic production with a focus on regenerative practices must lead the way. It is only through agricultural and other land management practices that eliminate petrochemical pesticides and fertilizers, and advance organic production on a global scale, from the United Nations to local communities in the Global South, that we stand a chance of making sustainable change in the long run for ourselves, our children, and the world at large.

Please consider helping Beyond Pesticides advocate for the transition to organic regenerative agriculture, and other benign land management approaches. You can join/contribute, take up the issue in your local community, organize with others for state-level action, and more; let us know if we can help: info@BeyondPesticides.org or 202.543.5450.

Signatories to the late November letter included: Keith Tyrell, Chair, Pesticide Action Network International; Million Belay, Coordinator, Alliance for Food Sovereignty in Africa (AFSA); David Azoulay, Environmental Health Program Director, Center for Inter-national Environmental Law (CIEL); Sofía Monsalve, Secretary General, FIAN International; Kirtana Chandrasekaran and Martín Drago, Food Sovereignty Program Coordinators, Friends of the Earth International; Sophia Murphy, Executive Director, Institute for Agriculture and Trade Policy (IATP); Andrea Carmen, Executive Director, International Indian Treaty Council (IITC); Pam Miller and Tadesse Amera, Cochairs, International Pollutants Elimination Network (IPEN); Sue Longley, General Secretary, International Union of Food, Agricultural, Hotel, Restaurant, Catering, Tobacco and Allied Workers' Associations (IUF); Laurent Gaberell and Carla Hoinkes, Agriculture and Food Experts, Public Eye; and Chee Yoke Ling, Executive Director, Third World Network.

SOURCE: Tyrell, Keith et al., Letter to Deputy Director Beth Bechdol, UN Food and Agriculture Organization, November 28, 2022.

SUBSIDIES DRIVE ENVIRONMENTAL COLLAPSE | FEBRUARY 25, 2022

Trillions in Subsidies Worldwide Are Driving Environmental Collapse Instead of Advancing Solutions

Together, governments of the world over are spending at least $1.8 trillion annually—2% of global gross domestic product—on subsidies that drive the destruction of ecosystems and species extinction and exacerbate the climate crisis. This news comes from a study commissioned by The B Team and Business for Nature, and released in a joint brief, *Financing Our Survival: Building a Nature Positive Economy through Subsidy Reform*. The Business for Nature website offers a remedy to this entropy: "With political determination and radical public–private sector collaboration, we can reform these harmful subsidies and create opportunities for an equitable, nature-positive and net-zero economy." To that end, the two organizations have issued, in their brief, calls to action to multiple sectors, including one to the governments participating in the coming UN Biodiversity Conference (COP15): "Adopt a clear and ambitious target within the Global Biodiversity Framework . . . that commits governments to redirect, repurpose, or eliminate all environmentally harmful subsidies by 2030 and increase positive incentives to enable an equitable, net-zero, nature-positive world."

A press release from The B Team reports that the fossil fuel, agriculture, and water sectors are the recipients of more than 80% of all environmentally harmful subsidies (EHS) annually, thus "depleting natural resources, degrading global ecosystems, and perpetuating unsustainable levels of production and consumption, in addition to exacerbating global inequalities." Other recipients of significant subsidy include the forestry, construction, marine capture fishery, and transport sectors. Business for Nature (BFN) comments, "In other words, public money is financing our own extinction."

The release of the brief and study is timely, given the early March UN Convention on Biological Diversity (CBD) COP15 Open Ended Working Group meeting in Geneva; the follow-on UN Biodiversity Conference (COP15) scheduled for April 25–May 8 in Kunming, China; and the next UN Climate Change Conference (COP27) in Sharm El-Sheikh, Egypt (rescheduled for November 2022). The study and report hope to inform decision makers in government and business on the case for, and how to, reform these environmentally damaging subsidies.

EHS, as the brief defines them, are government support programs that—though often established (at least ostensibly) to solve socioeconomic problems — ultimately encourage unsustainable production and/or consumption patterns,

largely because they were deployed without consideration of environmental impacts. Beyond Pesticides notes that many of the health and environmental crises have arisen because of such a "siloed" approach to problems, and that broadly, precautionary and holistic approaches can avoid such unintended and harmful impacts; see "Scientific Findings Support Replacing Poisons with Precaution" (p. 9).

The World Economic Forum puts failure to act robustly on climate, resulting extreme weather events, and biodiversity loss as the leading threats to humanity—catalyzed in part by the enormous amounts of money given by governments to support harmful industries and practices. The research finds that globally, the fossil fuel industry receives $640 billion in EHS annually; the agriculture sector, $520B; water, $350B; forestry, $155B; construction, $90B; transport, $85B; and marine capture fisheries, $50B. (The report also mentions that, though no metrics are available on EHS for it, illegal gold mining accounts for billions of dollars in damage each year.)

These subsidies are significant contributors to many of the crises the world faces: the rapidly heating climate, ecosystem and biodiversity loss, air and water pollution, land degradation, and social and economic inequality. A UN Development Programme and Food and Agriculture Organization report suggests, for example, that of the subsidies provided to farmers, nearly 90% distort prices or cause other harm, and that most fossil fuel subsidies hamper the critical and urgent need to transition to a clean energy economy globally.

The report also scolds governments for terrible follow-through on pledges made—and then ignored or unrealized.

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It notes, "During the 2010 UN CBD Summit, 190 countries committed to phasing out or reforming subsidies harmful to biodiversity by 2020 as part of the Aichi targets. Governments missed the target, and we cannot afford for history to repeat itself."

The brief acknowledges the extreme difficulty of reforming these subsidies: "Many of [them] are so deeply embedded in our economies that attempts to define, measure and track them often struggle to be comprehensive, and progress to reform them has been slow. This is due not only to the power of vested interests, but also because both the governments and beneficiaries—including business—are unaware of the full scale of the subsidies and their impacts. Businesses often lobby for continued or increased government support that often has negative unintended environmental consequences."

Among its observations are the needs for greater public awareness and visibility of EHS, and much more transparency and disclosure about subsidies from governments and recipient businesses. In the U.S., such subsidies tend to be "worked out" behind semi-closed doors among legislators, federal agencies,

lobbyists, and private business entities, and occasionally reported on by journalists—hardly the stuff of open, democratic, and accountable governance.

The report's summary asserts that reform adequate to the goals of reversing "nature loss" by 2030, and achieving net zero carbon emissions by 2050, will require roughly $700 billion annually—*far less* than is currently spent on funding climate- and nature-destructive governmental subsidy programs. The researchers and authors, Doug Koplow and Ronald Steenblik, say that these government efforts need to occur in parallel with (1) a realignment of all private financial flows so as to be "nature-positive," and (2) increased public and private financing that can deliver innovative financial solutions to protect, restore, and conserve nature.

"Nature-positive" is not comprehensively defined in the brief, but these outcomes can be inferred, from the brief itself and commentary on the BFN and The B Team websites, as qualifying: emissions reductions and the transition to renewably powered economies; restoration of damaged ecosystems and initiatives to arrest further biodiversity loss and restore damaged and endangered populations; support of social and economic needs of human populations, including redress of economic and environmental inequities; and support of nature-based solutions broadly. Importantly, BFN asserts that EHS reform must consider social and economic forces at play as it pursues "the imperative for a just and equitable transition. Reform managed sensitively means providing support for the poorest households and most vulnerable communities, such as via targeted cash transfers."

In the authors' view, such redirection of resources from harmful subsidies toward nature-positive outcomes would:

- free up substantial government resources to support social needs and local livelihoods
- redirect capital toward ecological restoration, including nature-based solutions
- close the biodiversity finance gap by reducing environmental degradation and unlocking the funding needed to mitigate it
- send more accurate signals to public and private investors and producers on where to direct R&D efforts and future investments
- accelerate innovation to reduce greenhouse gases and environmental damage
- create a level playing field for businesses, which would further encourage rapid transformation of business models
- unlock social benefits such as poverty reduction, improvements in education and other social services, and more sustainable approaches to providing basic access to energy, clean air, and water

Importantly, BFN asserts that EHS reform must consider social and economic forces at play as it pursues "the imperative for a just and equitable transition. Reform managed sensitively means providing support for the poorest households and most vulnerable communities, such as via targeted cash transfers.

The brief calls on businesses and investors to advocate with governments for reform of EHS through their repurposing or redirection, or elimination, and funding of "an equitable, net-zero, and nature-positive world by 2030." In addition, it asks that businesses (1) collaborate broadly to increase awareness of reputational, competitive, and investor advantages of subsidy disclosure, and (2) support the development of international standards, frameworks, and guidance for mandatory ESG (environmental, social, and governance) disclosures, including subsidies.

The report goes on to make a compelling business case for reforming systems of subsidies that fund destructive entities and practices by identifying risks and opportunities. Central to the risks is the inescapable fact that virtually all businesses rely on functional natural systems and resources for every aspect of their value chains. In addition, EHS, as noted above, distort pricing, investment decisions, and resource allocation; encourage unsustainable production and consumption (chickens will eventually come home to roost!), and unfair competition; and generate supply chain, reputational, and operational risks.

On the other side of the ledger, the draft points to opportunities that EHS reform and redirection of funding to nature-positive objectives would present. The authors assert that among those would be increased competitive positioning, increased ESG investor interest, reduction of the risks noted above, and progress on the "ambitions of the *Paris Climate Agreement*." (Inadequate as that particular set of accords is, that would still be a giant step in the right direction for many private enterprises.)

The brief summarizes: "Informed reform of subsidies can boost business and investment opportunities, create jobs, reverse nature loss and help ensure a sustainable future for our planet. Businesses can mobilize and implement change with speed (often faster than policymakers), setting a precedent for improvement across industry. Investors are starting to acknowledge the financial and sustainability risks of environmentally harmful subsidies and forward-looking companies recognize they need to prepare for subsidy reform."

The brief ends with a slew of endorsing comments from members of The B Team, business leaders, and advocacy groups. Several stand out to Beyond Pesticides:

- "It's time to stop the self-serving, short-sighted lobbying instead directing public money towards supporting responsible companies transition to nature positive business models." —Paul Polman, business leader and The B Team member
- "It is more important than ever to put in place ambitious targets to reverse nature loss and to redirect, repurpose

or eliminate all subsidies that harm our natural world."—Marco Lambertini, Director General of World Wildlife Fund International

- "We must break down the siloed approach that has led to putting subsidies in place without consideration of their long-term environmental costs." —Jennifer Morris, CEO, The Nature Conservancy

Activist 360 reports the comment of Mary Robinson, former president of Ireland and member of The B Team: "Climate action is at a crossroads, in part because of the large scale of public money flowing to harmful industries and practices. We need to see thorough subsidy reform from governments and businesses, with social and environmental considerations at the heart, to ensure a just and equitable transition for all."

Enacted, EHS reform could go a long way to mitigating climate and environmental harm, but such reform will likely be a slog, given the complexity and entrenched nature of national and international economic systems, the inherent conservatism—never mind the centrality of the profit motive—of most private enterprise, and the typically glacial pace of governments on reform efforts. Still, it is encouraging to see some portion of the business community stepping up to recognize its responsibility to remedy what it (as well as governments, militaries, and others) has caused, and advance the possibility of a livable and functional climate and environment.

Enacted, EHS reform could go a long way to mitigating climate and environmental harm, but such reform will likely be a slog, given the complexity and entrenched nature of national and international economic systems, the inherent conservatism—never mind the centrality of the profit motive—of most private enterprise, and the typically glacial pace of governments on reform efforts.

What to do: Beyond Pesticides would add to the ambitious scope of this brief and its sponsors that EHS reform, and the implied reform of supply chains, should directly address the toxicity of so much of the global materials stream—particularly, synthetic pesticides and fertilizers, plastics, and chemical ingredients of industrial and consumer products (see, e.g., this Daily News Blog article on PFAS and other toxics).

Multiple other articles have covered the need for companies to clean up their supply chains, and Beyond Pesticides advocacy on the issues—whether about garden center and other retail sale of plants treated with toxic pesticides, sale of contaminated "biosludge" as fertilizer, the ubiquity of untested chemicals, including those in plastics, or myriad others. Beyond Pesticides has also detailed the systemic ecosystem impacts of toxic chemicals and their damage to biodiversity.

Many, many products and ingredients are integral in causing the harms this brief addresses, and whose authors and supporters hope will inform decision makers at COP15 (the UN Biodiversity Conference). Beyond Pesticides encourages that the report be taken seriously, and that its influence leads to a genuine shift across the global business community toward nature-positive goals—redirection of policy and investment to repair and restore, rather than ravage, the climate and natural systems of this world.

SOURCES: Koplow, Doug and Steenblik, Ronald, *Protecting Nature by Reforming Environmentally Harmful Subsidies: The Role of Business*. Earth Track, February 2022.

GENETICALLY ENGINEERED FOOD LABEL MISLEADING | JANUARY 7, 2022

USDA Genetically Engineered Food Label Misleads Consumers, Took Effect January 1

Unbeknownst to most Americans when they woke up on New Year's Day 2022, a new labeling system for genetically modified-engineered foods—promulgated in 2019—which does not mention genetically engineered or GMO [genetically modified organisms] ingredients, went into effect. Consumer, food, and environmental advocates say that the new label is misleading, insufficiently transparent, discriminatory, rife with loopholes, and confusing for consumers. The new labeling requirement mandates that genetically engineered foods bear labels that indicate that they have been "bioengineered" or that provide a text-messaging phone number or a QR code as avenues for further information. ("Additional options such as a phone number or web address are available to small food manufacturers or for small and very small packages.") The new labeling rule from the U.S. Department of Agriculture (USDA) aims, according to the agency, to eliminate the crazy quilt of labels affixed to foods and ingredients that have been scientifically altered. According to an agency spokesperson, the rule is designed to "balance the need to provide information to consumers with the interest in minimizing costs to companies." [In September,

2022, the U.S. District Court of Northern California held that the use of QR codes alone is unlawful and USDA must provide other disclosure options that provide wide access to all consumers.]

Genetically altered food items and ingredients have heretofore been called, and labeled as, "genetically engineered" (GE) or "genetically modified" (GM), or as containing "genetically modified organisms" (GMO). *The Washington Post* reports that, "The new rule requires food manufacturers, importers and retailers to disclose information whether foods are bioengineered or use bioengineered ingredients, doing away with well-established terms like 'genetically engineered' and 'GMO' on labels. However, other kinds of official certifications like USDA Organic and NON-GMO Project Verified will be allowed."

The new labeling arises out of several developments in recent years. The first was the so-called *Safe and Accurate Food Labeling Act of 2015*, dubbed the DARK Act—the *Denying Americans the Right to Know Act*—by its many opponents. This legislation reacted to efforts in Vermont, Connecticut, and Maine to enact state laws that would mandate labeling of foods and ingredients that were genetically engineered, or contained such ingredients. The food industry was not happy with such developments, and spent huge sums to thwart state efforts. Some food companies even stopped selling to Vermont grocers in order to avoid the extra costs of labeling and segregating such products. The passage of the DARK Act preempted Vermont's successful GE labeling law, which required such items to be labeled as "produced with genetic engineering."

Other contributing developments were: (1) the 2016 Congressional passage of the *National Bioengineered Food Disclosure Act*, which directed USDA to establish a "national mandatory standard for disclosing foods that are or may be bioengineered," and (2) the Trump USDA's subsequent 2018 announcement of the National Bioengineered Food Disclosure Standard (NBFDS), which resulted in the 2019 announcement of the new labeling rule that became mandatory on January 1, 2022. That standard defined "bioengineered foods as those that contain detectable genetic material that has been modified through certain lab techniques and cannot be created through conventional breeding or found in nature."

Today, as much as 75 percent of the food Americans buy at their local grocery store, from cereals to soups, include genetically modified ingredients. However, most consumers are not aware that the foods they are eating include these ingredients.

The *Harvard Political Review* sums up the status of GE/GMO foods in the U.S. marketplace, and the history of the battles over labeling of such food. "Genetically modified crops, which primarily include corn, soybeans, canola, and sugar beets, have been grown in the United States for 20 years, and they have FDA [U.S. Food and Drug Administration] approval. Today, as much as 75 percent of the food Americans buy at their local grocery store, from cereals to soups, include genetically modified ingredients. However, most consumers are not aware that the foods they are eating include these ingredients."

GE/GMO proponents argue that such foodstuffs are safe for human

consumption. Opponents have a variety of objections (health and safety, pesticide contamination, ecosystem impacts, etc.) that are largely shared by Beyond Pesticides, but the central issue has been consumers' right to know what they are purchasing and ingesting. Out of concern for all of those issues arose the "Just Label It" campaign, on which Beyond Pesticides partnered, and about which it wrote, nearly a decade ago, "Beyond Pesticides' goal is to push for labeling as a means of identifying products containing GE ingredients and allow for consumer choice that will drive the market toward sustainable practices."

This shift to the term "bioengineered" for labeling has been roundly criticized by advocates. Director of the project on biotechnology for the Center for Science in the Public Interest, Gregory Jaffe, has commented, "The worst part of this law is the use of the term 'bioengineered' because that's not a term most consumers are familiar with," adding that the move to the new jargon was made primarily because "GMO" had come to be perceived as pejorative.

In the summer of 2020, the Center for Food Safety (CFS) filed suit against the Trump administration's National Bioengineered Food Disclosure Standard and proposed labeling rule. CFS "seeks to have the court declare the regulations unlawful and nullify them, and then return the issue to USDA with orders to fix the unlawful portions of the rules." The organization claimed that the new regulation includes provisions that "will leave the majority of GMO-derived foods unlabeled; discriminate against tens of millions of Americans; prohibit the use of the widely known terms "GMO" and "GE"; and prohibit retailers from providing more information to consumers." [Court ruled in September that a standalone QR code is unlawful.]

Among the objections CFS cites in its case are:

- unprecedented allowance of electronic or digital disclosure on packaging, also known as "QR code" or "smartphone" labeling without requiring additional on-package labeling
- the discriminatory nature of such digital "portals" to information, given that "at least 20 percent of the American adult population—primarily poor, elderly, rural, and minority populations—have lower percentages of smartphone ownership, or live in areas in which grocery stores do not have internet bandwidth"; (*The Washington Post* reports that "the new rules discriminate against the more than 100 million Americans who do not have access to smartphones or cell service, because companies will be allowed to rely on smartphone-based scannable QR codes to share information with consumers.")

USDA's Disclosure Standard strips away the hard-fought labeling requirements of states—requirements Congress sought to encompass—replacing them with inaccessible digital disclosures, unfamiliar terminology, and an extra-statutory definition of bioengineered food.

- the rule's restrictions on label language: when on-package text *is* used, the rules limit the adjective used to only "'bioengineered,' despite the fact that for 25 years, every aspect of the issue—[in] science, policy, and [the] marketplace—has used genetically engineered (GE) or genetically modified (GMO)"
- the "loopholes" that would exempt many GE foods from the new labeling requirements

In its litigation, CFS argues that the new rule violates the *National Bioengineered Food Disclosure Act*, the *Administrative Procedure Act* (APA), and the U.S. Constitution. The first of those aimed to protect the public's right to know what is in their food and how it is produced; USDA was tasked by that law with creating and implementing rules to achieve those aims. Plaintiff's case documents state: "USDA's final rule ignores virtually all the Disclosure Act's statutory provisions designed to ensure disclosure of all GE foods for all Americans. Instead, USDA's Disclosure Standard strips away the hard-fought labeling requirements of states—requirements Congress sought to encompass—replacing them with inaccessible digital disclosures, unfamiliar terminology, and an extra-statutory definition of 'bioengineered food.' USDA's flawed rationales for doing so violate the plain language of the Disclosure Act and are arbitrary and capricious under the APA."

The suit also asserts that "the Disclosure Standard violates regulated entities' First Amendment rights to provide disclosure to consumers, violates states' Tenth Amendment rights by overbroadly prohibiting state laws related to GE seed labeling, and violates the Fifth Amendment by using vague and contradictory language, allowing for arbitrary enforcement." CFS adds, in its case documents: "Left standing, the Disclosure Standard will result not only in de facto concealment of GE disclosures, but also a dangerous precedent for truthful and non-misleading commercial speech and for Congress's power to commandeer state governments. Accordingly, this Court should set aside the arbitrary and unconstitutional Disclosure Standard and sever and declare invalid constitutionally infirm provisions of the Disclosure Act." CFS filed a motion for summary judgment in the case in early December, 2021. (Such a motion asks a court for a judgment on the merits of a case prior to the actual trial; this is typically done when the dispute is about a question of law, rather than the facts of a case.)

The net impact of the new labeling schema, according to advocates, is that it puts a far greater burden on consumers to figure out what the labels mean, to "do their homework" so they are adequately informed (especially because there is, to date, no broad public campaign to apprise them of the change), and—if industry takes the least transparent path

of using QR codes and text messaging rather than labels—to have to resort to in-the-moment "research" in the grocery store via smart phones they may or may not have and in settings that may or may not have cell or Wi-Fi service.

An issue for many advocates is the vast number of food items that would not be covered by the new labeling requirements. The NBFDS exempts "(1) foods served in a restaurant, (2) very small food manufacturers with annual receipts of less than $2.5 million, (3) food certified under the USDA National Organic Program, and (4) food in which no ingredient intentionally contains a bioengineered substance, with an allowance for inadvertent or technically unavoidable presence of up to 5% for each ingredient."

CFS elaborates on this "loophole" issue and notes an additional concern: "The vast majority of GE foods (by some estimates over 70%) are not whole foods, but highly processed foods with GE ingredients, like sodas and oils. Yet in the final rule, USDA excluded these 'highly refined' products unless the GE material is 'detectable.' Lastly, the statute invalidates state GE seed labeling laws and prohibits future GE seed labeling laws in violation of states' rights to regulate in the absence of federal regulation." Even *Forbes* magazine has weighed in, writing that, "One failing of the bill is that even the Food and Drug Administration (FDA) says that the definition of 'bioengineering' in the bill is too narrow and would not apply to many foods that come from genetically engineered sources."

CFS Executive Director Andrew Kimbrell wrote, in a late December 2021 update on the organization's litigation, "These regulations are not about informing the public but rather designed to allow corporations to hide their use of genetically engineered ingredients from their customers. It is a regulatory scam which we are seeking to rescind in federal court. In addition, we are urging our million CFS members and others to become citizen investigators and find and expose the companies that are using QR codes instead of on-package text or symbol labeling, thereby trying to keep us in the dark about what they have put in our food."

Beyond Pesticides Executive Director Jay Feldman had this to say: "This label is recognition by USDA and 'Big Food' that full and honest disclosure of GMO/GE ingredients will hurt the market. In the end, lying to consumers will not work, but it may hurt the value and credibility of other USDA labels, such as the USDA Certified Organic label that we have worked so hard to create in order to convey meaningfully important information about organic criteria, standards, and enforcement."

Few stakeholders appear thrilled by this rule at this moment in time. Some food companies, according to their trade groups, are asserting that instituting this new rule mid-pandemic, and during a supply-chain crisis, puts a significant burden on a sector already struggling. The Consumer Brands Association has urged USDA to pause implementation temporarily; a spokesperson commented: "We believe the government must take a 'do no harm' position right now that allows companies to focus on delivering essential products to consumers."

Long a proponent of transparency about the food supply, a few years ago Beyond Pesticides published advocacy points on the flaws of the then-anticipated labeling schema, asking USDA to "ensure that labels are honest, transparent, and informative by adopting the following policies":

- reject package labeling with unreliable "QR codes" and other discriminatory communication methods; such options discriminate against more than 100 million Americans—especially many in rural communities, as well as low-income, people of color, and elderly populations that tend disproportionately to lack access to these technologies
- require labeling to use only common, well-established labeling terms, such as GE or GMO; do not allow these to be replaced with the term "bioengineered"
- require all foods produced with genetic engineering—including highly processed oils and sugars—to be labeled
- include new and future methods of genetic engineering, such as CRISPR
- ensure harmonization with the European Union by requiring disclosure if unintended GE contamination exceeds the current level of detection

The vast majority of GE foods (by some estimates over 70%) are not whole foods, but highly processed foods with GE ingredients, like sodas and oils. Yet in the final rule, USDA excluded these "highly refined" products unless the GE material is "detectable."

What to do: In light of the new labeling, consumers would do well to "do their homework" ahead of time, or in the grocery store, in order to parse the meaning of the new labeling. (*The Washington Post*'s coverage of the new rule includes a useful "What to Know" section to help consumers understand implications of the rule for foods they buy and consume.) Perhaps an easier approach, for those who want to avoid GE/GMO food items, is to buy organic much as possible because USDA National Organic Standards disallow the use of GEs/GMOs.

SOURCE: Reiley, Laura, "The USDA's new labeling for genetically modified foods goes into effect Jan. 1. Here's what you need to know." The Washington Post, January 1, 2022; Natural Grocers, et al. v. Thomas Vilsack, et al. USDA. U.S. District Court, Northern District of California. Case No. 20-CV-05151-JD. September 13, 2022.

SUPREME COURT UPHOLDS LAWSUITS AGAINST MONSANTO/BAYER | JUNE 22, 2022

Supreme Court Permits Large Jury Verdicts on Roundup, Appeals Court Finds EPA Registration Unlawful

Bad news is piling up for Bayer (Monsanto) and its carcinogenic flagship weed killer, glyphosate (Roundup). Last week, the Court of Appeals for the Ninth Circuit handed down a ruling that held the U.S. Environmental Protection Agency's (EPA) 2020 approval of its notorious weed killer glyphosate unlawful. Then, yesterday, the U.S. Supreme Court declined to consider (deny certiorari) Bayer's "Hail Mary" petition attempt to save the company from being held accountable to those diagnosed with cancer after using Roundup (glyphosate) herbicides. In both cases, the courts are acting as a check on a company, while EPA regulators charged with stopping this behavior continue to rubber stamp the agrichemical industry's dangerous decisions.

This is not the first time that the Supreme Court has upheld the rights of victims of the pesticide industry. In 2004, *Bates v. Dow Agrosciences* (U.S. Supreme Court, No. 03-388), the court found: "The long history of tort litigation against manufacturers of poisonous substances adds force to the basic presumption against preemption. If Congress had intended to deprive injured parties of a long available form of compensation, it surely would have expressed that intent more clearly. See *Silkwood v. Kerr-McGee Corp.*, 464 U.S. 238, 251 (1984). Moreover, this history emphasizes the importance of providing an incentive to manufacturers to use the utmost care in the business of distributing inherently dangerous items."

"In rejecting Bayer's effort to reverse jury verdicts for harming people with its cancer causing weed killer glyphosate, the Supreme Court is preventing the company from running roughshod over the environment and public health, poisoning people and flaunting health and safety laws, while EPA regulators shrug off the rule of law," said Jay Feldman, executive director of Beyond Pesticides. Regarding the Ninth Circuit decision, Mr. Feldman said: "EPA's failure to act on the science, as detailed in the litigation, has real-world adverse health consequences for farmworkers, the public, and ecosystems. Because of the Appeals Court lawsuit, the agency's obstruction of the regulatory process will not be allowed to stand, and EPA should start shifting food production to available alternative non- and less-toxic practices and materials that meet its statutory duty." Represented by Center for Food Safety, the petitioners in the lawsuit included the Rural Coalition, Farmworker Association of Florida, Organización en California de Lideres Campesinas, and Beyond Pesticides. A consolidated case is led by Natural Resources Defense Council and includes Pesticide Action Network North America.

In the Ninth Circuit decision, the court voided EPA's "interim registration review" decision approving continued use of glyphosate, issued in early 2020. "EPA did not adequately consider

whether glyphosate causes cancer and shirked its duties under the *Endangered Species Act* (ESA)," the court wrote in its opinion.

The court held that EPA unlawfully concluded that glyphosate does not pose a cancer risk. Despite overwhelming evidence and Bayer's high profile lawsuits, EPA came to "no conclusion" on glyphosate's connection to non-Hodgkin lymphoma (NHL). Notably, the agency did not assess how much glyphosate gets into a user's bloodstream after skin contact with the herbicide, a major route of exposure for the chemical. Skin irritation was noted as one of the initial concerns for Dewayne Johnson, the school groundskeeper who won the first legal case against Bayer/Monsanto after contracting NHL.

The court criticized EPA for its "disregard of tumor results;" its use of "bare assertions" that "fail[] to account coherently for the evidence;" making conclusions that do not "withstand[] scrutiny under the agency's own framework," and "fail[ing] to abide by" its cancer guidelines. In sum, the court noted EPA's "inconsistent reasoning" made its decision on cancer "arbitrary," and struck it down.

"We welcome and applaud the court on this significant decision," said Jeannie Economos, Pesticide Safety and Environmental Health Project Coordinator at the Farmworker Association of Florida, a plaintiff in the case. "While it comes too late for many farmworkers and landscapers who suffer after glyphosate exposure, we are grateful for the court's ruling, and hope that now EPA will act quickly to protect future workers from illness and disease resulting from this toxic pesticide."

The Ninth Circuit also held that EPA violated the *Endangered Species Act* in reapproving glyphosate. After this lawsuit was launched, EPA filed a motion confessing that the agency made errors in its review of endangered species, including glyphosate's harm to imperiled monarch butterfly habitat. While asking the court for a re-do to study the dangers monarchs are already being subject to, EPA nonetheless asserted that glyphosate should stay on the market.

As a result of the decision, EPA is required to redo and/or finish all remaining glyphosate determinations within four months, by October 2022. Specifically, EPA must redo its ecological toxicity assessment, cost analysis on the impacts of pesticide harms to farmers, and its endangered species analysis and mitigation.

Advocates and court watchers reacting to the Ninth Circuit case had been concurrently waiting for the Supreme Court to issue a determination on whether it would take up Bayer's ongoing civil court cases holding it liable to those diagnosed with cancer after using Roundup (glyphosate). That case centers on the legal theory of preemption, with Bayer arguing that the "failure to warn" lawsuits it was subject to were preempted by federal law. In other words, Bayer argued that because EPA's registration process allowed the chemical to market, it was under no obligation to convey health dangers about its weed killer.

In response to the Supreme Court petition, the Biden administration's Solicitor General sided with Roundup victims and in an amicus brief urged the Supreme Court not to take up the case. In reaction, Bayer tried to get tough, and employed proxy organizations to put pressure on the Biden Administration and Department of Justice to rescind the letter, expressing "grave concern" about the Solicitor General's opinion.

As the Ninth Circuit case shows, EPA's review of glyphosate was lackluster, incomplete and failed to adequately capture the dangers posed by the herbicide. Of Bayer's "Five Point Plan" for addressing the catastrophe around glyphosate, a significant amount hinged on a favorable decision from the Supreme Court. Without review by the high court, Bayer will need to reengage with the over 31,000 plaintiffs it decided to ignore right after it launched its petition. According to news reports, the corporation "respectfully disagrees" with the Supreme Court decision. It also indicates it will continue to gum up federal courts with its frivolous requests.

"While [the Supreme Court] decision brings an end to the Hardeman case, there are likely to be future cases, including Roundup cases, that present the U.S. Supreme Court with preemption questions like Hardeman and could also create a circuit split," Bayer said in a statement posted by Progressive Farmer DTN about a $80 million jury verdict against the company in *Edwin Hardeman v. Monsanto Co.* "The company is strongly encouraged by the widespread support from public officials, agricultural organizations and other stakeholders following the U.S. government's legal reversal in Hardeman."

The "widespread support" Bayer enjoys is generally associated with its business alliances and efforts to wield corporate influence over elected officials and in regulatory affairs. While the courts continue to act as a last resort for the rule of law and science-based decision making, advocates are calling for the overhauling of government agencies that ensure that they are meeting their charge to protect people and the environment, not the profits of giant corporations like Bayer/Monsanto.

Without needed reforms, EPA redoing their work, as required by the Ninth Circuit ruling, is unlikely to result in an outcome that is clearly protective. Advocates insist that with clear evidence on the dangers posed by glyphosate-based herbicides like Roundup, there is no more time for games that placate industry at the expense of public health and environmental sustainability.

What to do: When challenged by the influence of concentrated money and power, Beyond Pesticides aims to bring scientific transparency, advocacy, sound policy, and meaningful legal actions to the table. But our success depends on your help in promoting these critical messages. Get active today by taking action to protect pollinators like the monarch butterfly, putting pressure on Congress to reform America's pesticide law.

SOURCE: NRDC, et al. v. U.S. Environmental Protection Agency. United States Court of Appeals for the Ninth Circuit. No. 20-70787, June 17, 2022; Center for Food Safety press release, June 17, 2022.

BILL TO BAN PESTICIDES ON NATIONAL WILDLIFE REFUGES | AUGUST 2, 2022

U.S. Senators Urge Fish and Wildlife Service to Phase Out Pesticide Use in America's Wildlife Refuges

Members of the United States Senate are calling on the U.S. Fish and Wildlife Service (FWS) to phase out the use of toxic pesticides in National Wildlife Refuges in order to protect declining wildlife species and the country's unique natural resources. Led by Senator Cory Booker (D-NJ), the Senators sent a letter to FWS Director Martha Williams urging FWS to "expeditiously begin a rulemaking process to phase out the use of agricultural pesticides on National Wildlife Refuges." The move comes at a time when native wildlife and the ecosystems humans rely upon are under greater threats than ever before from climate change, habitat destruction, and the indiscriminate use of toxic pesticides.

"The Refuge System was established to provide sanctuary for listed threatened and endangered species, migratory birds, and other wildlife," wrote the Senators in a letter to U.S. Fish and Wildlife Director Martha Williams. "The Refuges' migratory sanctuary and breeding grounds are especially critical for North American birds, as they have faced precipitous population declines; there are 3 billion fewer breeding birds in North America than there were in 1970. Unfortunately, these birds and other threatened species are being put at risk by pesticide use in the Refuges that were designed to protect them."

In 2012, Beyond Pesticides and other environmental groups, led by Public Employees for Environmental Responsibility (PEER) and Center for Food Safety (CFS), won a court battle to halt genetically engineered (GE) crops and related herbicide-tolerant herbicides on wildlife refuges in the southeast. This move was followed a year later by the FWS Pacific Region restricting the use of neonicotinoids, which are often applied to the seeds of GE crops, in their refuge areas.

Under the Obama Administration in 2014, the former Chief of the National Wildlife Refuge System officially phased out the use of genetically engineered crops and neonicotinoids insecticides on all U.S. wildlife refuges. The decision, as outlined in a memorandum by former Chief James Kurth, was based on the fact that neonicotinoid use, and the harms associated with it, "is not consistent with Service policy…[]based on a precautionary approach to our wildlife management practices and not on agricultural practices."

Despite these important restrictions, other toxic agricultural pesticides registered by the U.S. Environmental Protection Agency continued to be sprayed in these sensitive and protected sites. A report by the Center for Biological Diversity (CBD) found that in 2016 alone over 270,000 acres were sprayed with more than 490,000 pounds of hazardous pesticides. These concerning statistics did nothing to phase the new, industry-friendly Trump administration. In 2018, the Fish and Wildlife Service released a memorandum reversing the 2014

restrictions on neonicotinoid pesticides, allowing use on a "case-by-case basis."

This industry-friendly reversal unnecessarily exposes a broad range of threatened and endangered wildlife to chemicals that do not belong anywhere near protected natural areas. As the Senators write, these chemicals "leach into the surrounding groundwater and soil and are picked up by native flowering plants and pollinators." Not only does this threaten nontarget organisms, the Senators note, but also the 53 million annual human visitors to U.S. Wildlife Refuges.

In 2019, CBD and CFS sued FWS and the Interior Department. "It's frankly astounding that anyone would promote spraying dangerous pesticides on wildlife refuges but if anyone would, it's the pesticide pushers in the Trump administration," said CBD senior attorney, Hannah Connor, at the time. "This is nothing but a shameless giveaway to the pesticide industry with no regard for our nation's most vulnerable wildlife." A year later, a federal judge rejected the lawsuit, allowing rampant contamination of some of the nation's otherwise most pristine sites.

An update to CBD's report was released, finding pesticide use in 2018 expanded 34% since 2016 to more than 363,000 acres of wild lands. Use of the most dangerous pesticides increased by more than 70% within this time frame.

To remedy the situation, the Senators are calling for the refuge system to go further than before and work to eliminate all toxic pesticide use in favor of the least-toxic, yet still effective minimum risk products on the market compatible with organic land care. The letter to FWS also asks for provisions that permit pesticide use on non-native species only for a limited basis, if compatible with a Refuge's Comprehensive Conservation Plan. "As for a short-term fix," the Senators say, "We ask that the 2014 memorandum issued by the United States Fish and Wildlife Service Chief James Kurth be reinstated, phasing out neonicotinoids." In addition to Senator Booker, Senators Ed Markey (D-MA), Bernie Sanders (I-VT), Kirsten Gillibrand (D-NY), Elizabeth Warren (D-MA), Alex Padilla (D-CA), Dianne Feinstein (D-CA), and Martin Heinrich (D-NM) signed on to the letter.

What to do: Help support the efforts of these Senate champions by joining calls to urge FWS to reinstate Refuge System protections. Further support Senator Booker's steadfast efforts to protect American children and the wider environment from toxic pesticides by urging your own Senators to join in cosponsoring the *Protect America's Children from Toxic Pesticides Act.*

SOURCE: Booker, Cory, et al. Letter to Director Martha Williams, US Fish & Wildlife Service. Uly 22, 2022; Senator Cory Booker (D-NJ) press release

LONG PHASEOUT OF WOOD PRESERVATIVE AFTER MARKET COLLAPSE | FEBRUARY 8, 2022

With Market Collapse, EPA Cancels Highly Hazardous Wood Preservative Years after Worldwide Ban

After nearly a century of use, the U.S. Environmental Protection Agency is officially cancelling the highly toxic wood preservative pentachlorophenol (penta). As one of the most dangerous pesticides ever produced, penta poses unacceptable risks to workers and surrounding communities, as manufacturing plants often became superfund sites. See Beyond Pesticides' report, *Poison Poles*. According to the agency, "During the registration review process, EPA found that given the emergence of viable alternatives, the risks pentachlorophenol poses to workers' health outweigh the benefits of its use." Health and environmental advocates are pleased with the agency's long overdue action on penta, but remain incredulous that EPA has provided a generous phaseout for the utility and wood preservative industry, allowing use to continue for up to five years. Beyond Pesticides has been working to ban pentachlorophenol, creosote, and copper chromated arsenate since its founding in 1981. (See history of Beyond Pesticides' work and litigation.)

EPA's statement on alternatives and workers' health is a telling example for the public regarding the way in which the agency consistently places economic decisions above American's safety. EPA has long known about the dangers penta poses to health, particularly the health of workers in penta production or treatment plants. In 2008, the agency determined that these occupational handlers had a 1 in 1,000 risk of developing cancer. Rather than cancel the chemical at that time to protect worker health, the agency opted to attempt additional mitigation measures, requiring further personal protective equipment, engineering controls, and changes to treatment procedures. With no real-world evidence that this would make a difference, the agency expected these changes to drop the cancer risk to workers. However, in its most recent draft risk assessment, EPA found that this drastically high cancer risk remained the same. (EPA considers cancer risk between 1 in 10,000 and 1 in 1,000,000 cases to be "acceptable.")

A close read of EPA's statement makes it clear: workers were expendable until the wood preservative industry had economically viable alternative chemistries it could use. In fact, EPA's cancellation decision still leaves workers at risk. According to EPA's decision document, the agency "considered requiring

additional interim risk mitigation measures during the period prior to the cancellation," but decided against doing so because they "may take several years to adopt and require significant financial resources in order to implement." Instead, EPA opted to provide the wood preservative industry five more years to transition to other materials.

The agency will require registrants to voluntarily cancel their penta products by February 29, 2024. EPA will then provide another three years for registrants to utilize their leftover stocks of penta, placing a hard end date on February 29, 2027. In response to Beyond Pesticides' comments, the agency does indicate it will require mandatory cancellation should current registrants not follow through voluntarily.

EPA's rationale for their five-year phaseout is not to protect health or the environment. Simply, it is what the industry told the agency it wanted. "The Agency does not, however, support a phase-out period of less than 5 years due to the potential disruption in the utility pole market," the final decision reads. When Beyond Pesticides asked pointedly in comments to speed up the cancellation period, the agency indicated that five years was an acceptable compromise because some commenters requested a phase out period longer than five years.

It is worth noting that the agency has the authority to immediately cancel hazardous chemicals—particularly those like penta, which has an immense body of data on its harm that could withstand industry's legal challenges. In this context, EPA's approach to protection has been more focused on the wood preservative industry's than on the environment, worker, or resident health. At every turn, once risks were identified, EPA took steps to keep penta on the market, and protect industry interests over human health.

In the late 1970s, a range of significant risks were identified, and penta underwent an EPA Special Review. The agency identified chronic harms from penta exposure, including contaminants such as hexachlorobenzene, furans, and polychlorinated dibenzo-p-dioxins, one of the most toxic substances known to humankind. But industry pressure resulted in EPA focusing on "risk reduction measures" rather than elimination. Products were restricted from residential use, but significant use remained for railways and utility lines. And rather than require improved production processes that eliminated dioxin contamination, the agency negotiated with industry to allow it to phase down contamination levels over several years. (Despite decades of time to improve production processes, current EPA documents show hexachlorobenzene and dioxin remain at hazardous levels of contamination in penta treated wood [19.3ppm and .55ppm average in 2013]).

Beyond Pesticides then sued EPA in the early 2000s urging cancellation of the chemical. The suit was ultimately struck down over administrative issues. 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 for children. But rather than protect children, EPA simply removed the exposure scenario for children and echoed a claim by the Penta Council, an industry group, that "play activities with or around pole structures would not normally occur."

When the *Stockholm Convention on Persistent Organic Pollutants* (POPs)

considered an international ban of penta, EPA and the U.S. government engaged in the process, and opposed listing penta, despite not being a signatory to the *Stockholm Convention*. Ultimately, however, the U.S. failed to convince other nations that the risks were worth the benefits of penta use, given the availability of alternative pole materials and the ability to bury lines.

To finally ban penta in the U.S., it took grassroots advocates, intrepid reporters, and courageous lawmakers to eliminate the wood preservative's last economic opportunity. After the *Stockholm Convention* listed penta, it set a clock ticking on production plants throughout the world. The last plant in Mexico was set to be shuttered, leaving the U.S. as the only possible location left where this internationally banned material could be produced. As a result, Gulbrandsen Chemicals, a multinational company with ties to India, attempted to supply the U.S. market by proposing to build a penta plant in the majority low-income African American community of Orangeburg, South Carolina. Residents and local lawmakers fought back. A series of high-profile investigative reports, community advocacy, and political action upset the plans announced by Gulbrandsen Chemicals, and it withdrew its plan.

EPA cited this fact under "other considerations" in announcing the cancellation. In comments, Beyond Pesticides urged the agency to base its decisions not on the "uncertain future of pentachlorophenol production" and instead on the statutory requirements for *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA) registration—that the chemical poses an unreasonable risk. For EPA's part, it denies that it based cancellation on the uncertain future of penta production—that point was simply noted to provide context, according to the agency. EPA reiterated that it based its decision on its risk/benefit calculation, as well as international support to ban penta. Opining for wood preservative manufacturers, "EPA expects that industry's decision to cease production of pentachlorophenol is a reflection, not a cause, of the same factors," the agency's final decision reads.

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Despite its failure to take immediate action, the agency did say, "[E]PA is requiring cancellation of pentachlorophenol based on the Agency's determination that the benefits of pentachlorophenol—in particular in light of the emergence of newer, safer alternatives. . .". To truly show it is evaluating hazardous wood preservatives based on the letter of the law, rather than the reflections of industry, EPA should take immediate action on other wood preservatives that have viable alternatives. Chief among the remaining alternatives is creosote, which was recently featured as part of EPA Administrator Regan's Journey to Justice tour, where he heard from residents of Houston, Texas's Greater Fifth Ward, which is still dealing with legacy contamination from a creosote railroad tie treatment plant.

Like penta, creosote production has resulted in immense suffering for workers and residents in fenceline communities near penta production and wood treatment sites. Like penta, there are a range of viable alternatives to its use, including alternative chemistries, as well as nontoxic products like steel, concrete, and fiberglass. And like penta, there is a small group of individuals profiting generously while people and the environment continue to be harmed. While EPA should be applauded for finally cancelling penta, its phase out period is far too generous. If the agency wants advocates to see it is serious about protecting health and the environment, this action can only be the first step as part of broader, long-overdue efforts to clean up the wood preservative market.

What to do: Beyond Pesticides has published extensive documentation on the history of penta production and regulation. For more information see the following articles:

- Poison Poles (1997)
- Pole Pollution (1999)
- Beyond Pesticides comments to EPA on Wood Preservatives (2008)
- Beyond Poison Poles: Elected officials say no to toxic utility poles in their communities (2014)
- United Nations Committee Recommends Global Elimination of Toxic Wood Preservative (2014)
- EPA Seeks to Block a Worldwide Ban of a Highly Toxic Wood Preservative (2014)
- International Treaty Bans Pentachlorophenol, U.S. Continues Use on Utility Poles, and Railroad Ties (2015)
- Settlement Reached in Lawsuit Over Dioxin Contamination from Poison Poles in Central California (2018)
- As the World Bans Highly Toxic Wood Preservative, Pentachlorophenol, a Low-Income U.S. Community May Be Home to the Last Production Plant (2020)
- Environmental Racism Strikes South Carolina Community with Siting of a Pentachlorophenol Wood Preservative Plant (2021)
- EPA Proposes Cancellation of Highly Toxic Wood Preservative Pentachlorophenol

See Beyond Pesticides Wood Preservatives web page. Take action in your community to ban utility poles and railroad ties treated with hazardous pesticides.

SOURCE: U.S. Environmental Protection. Pentachlorophenol: final Registration Review Decision, Case Number 2505, EPA-HQ-OPP-2014-0653. December 22, 2021, posted at regulations.gov, February 4, 2022

DOG DEATH COVER-UP | APRIL 1, 2022

Cover-up of Dog Deaths at EPA, According to Internal Emails on Seresto Flea and Tick Collars

According to reporting by *E&E's Greenwire*, internal emails at the U.S. Environmental Protection Agency (EPA) show that career scientists at the agency expressed worry about pesticide-laced pet collars, such as the notorious Seresto flea and tick collars, but that EPA managers "instructed them to avoid documenting those worries in publicly accessible records." The emails were released pursuant to a 2021 FOIA (*Freedom of Information Act*) lawsuit, brought by the Center for Biological Diversity (CBD), that sought records of internal communications. The documents evidence staff concern about the collars that has *not* been a part of EPA's public communications on the subject. EPA staff, in the emails, expressed a range of degrees of outrage at managers' behavior and at the very registration of the product, given the significant harms.

Seresto collars are plastic pet collars embedded with pesticides designed to kill fleas, ticks, and lice; they contain the active ingredients flumethrin and imidacloprid. Flumethrin, a chemical in the pyrethroid class of synthetic neurotoxic insecticides, has been linked repeatedly to neurological issues, such as seizures and learning disabilities in children, to gastrointestinal distress, and to damage to nontarget invertebrates, according to EPA's own analysis.

Imidacloprid is a commonly used pesticide linked to serious health and environmental decline. A neurotoxicant, endocrine disruptor, and immunosuppressant, the compound can have harmful reproductive impacts and is linked to cancer. It is toxic to birds, bees, and aquatic organisms, and persists in aquatic environments. Banned for outdoor use across the European Union, it is nevertheless allowed by EPA in in pet collars and other treatments. Consistent with EPA's track record, the potential synergistic impacts of exposures to flumethrin and imidacloprid via the Seresto collars have not been evaluated.

In 2020, Beyond Pesticides added to the litany of harms with its coverage of additional problems with pet flea treatments—the contamination of waterways in both England and the U.S.

In Spring 2021, Beyond Pesticides wrote about the collar's link to nearly 1,700 pet deaths, as well as injuries to tens of thousands of animals and hundreds of people, and noted: "Numerous flea and tick prevention products (e.g., collars, topical treatments, sprays, and dusts) include pesticides such as tetrachlorvinphos (TCVP), propoxur, synthetic pyrethroids, and fipronil. A common trait among these pesticides is their toxicity, not just to dogs and nontarget organisms, but to humans, as well." Advocates have warned about the toxicity of the pesticides embedded in such collars (and other pet treatments), which are a health threat not only to pets, but to humans and, especially, to children.

CBD notes that EPA has received more than 75,000 complaints about

the collars, associating their use with problems ranging from skin irritation to death. *Gizmodo* puts the current count of complaints to EPA about Seresto, since 2012, at more than 86,000—with 2,340 of those relating to pet deaths. CBD's environmental health director, Lori Ann Burd, commented that—given EPA's estimate of the ratio of pesticide incidents "in the real world" to complaints filed with EPA as roughly 5:1—a sensible extrapolation is that many more pets wearing Seresto collars have been hurt or have died than are represented by reports filed with the agency.

EPA has, according to *Greenwire*, dragged its feet for years on action on various pet collars (and related products). The Natural Resources Defense Council (NRDC) has brought multiple suits related to these collars, starting in 2007, because of their harms to children and pets. In addition to the controversy surrounding the Seresto collar, *EENews* reports, TCVP—used in collars manufactured and sold by the Hartz Mountain Corporation—has been a concern. In April 2020, a federal appeals court judge ordered EPA to act on an NRDC suit to ban the use of TCVP after EPA had denied previous NRDC petitions that sought the same.

An NRDC statement simultaneously marked the legal victory and called out the agency for its failure to act on the science: "In 2016, EPA scientists finally acknowledged the danger this toxic chemical poses to children, but the agency then failed to remove the dangerous pet products from the market. It's especially gratifying, on Earth Day, to have the court hold EPA accountable to its 'core mission' to 'protect human health and the environment." Yet this toxic compound is still allowed for use by EPA. As NRDC asserts, despite six other dangerous organophosphates once used in pet products having been removed from the market, "use of TCVP in pet flea collars is the last remaining residential use of this toxic family of chemicals."

CBD has filed a legal petition to ban the Seresto collar. CBD argues that the Seresto product should be cancelled because of its unreasonable risks to pets, human health, and the environment. CBD notes that, "No other pesticide product has been the subject of this many incident reports, according to a former pesticide researcher and policy analyst for the EPA."

CBD attorney Hannah Connor remarked in July 2021 that if EPA "wants to show that it has truly recommitted to its mission of using the best available science to protect human health and the environment, then it must take swift action to cancel its approval of this troubling product." In July 2021, EPA announced the opening of a 60-day comment period on that petition, which period ended in September 2021. EPA has said that it will respond to the petition after reviewing its evaluation of the product, but there has been no word as yet from the agency on the status of that evaluation.

Greenwire notes that EPA has been "vague" in its response to consumer concern about the Seresto collar. The agency said in a July 2021 statement that, "EPA understands and shares the public's concerns about reported incidents with Seresto pet collars. The agency is working to gather information about these incidents and will use this information to determine whether these pet collars still meet the legally required safety standard for registration under FIFRA [*Federal Insecticide, Fungicide, and Rodenticide Act*]." The sanguine tone of that announcement apparently belies what has gone on behind the scenes at EPA.

The released internal EPA emails demonstrate that career scientists and staffers inside the agency have pushed back internally with their concern and frustration about EPA's handling of the complaints about Seresto and harms to pets, and about the very registration of the product. Among the discoveries in the documents were these:

- In response to a query (from a staffer at the California Department of Fish and Wildlife) about use of Seresto collars on kit foxes in the southwest U.S., which asked who at EPA would be the best person to consult about it, an EPA scientist responded: "It depends if you want the real answer or just some talking points to cover our ass for doing nothing."
- One EPA staff member wrote, "Why is Seresto even registered? At the very least Seresto should not be used on the endangered San [Joaquin] kit fox"—to which a manager at EPA replied, "It would be inappropriate for you to respond in your official capacity and express your personal opinions." The staffer fired back, noting that manager's (and others') previous directives to staff "not to express [their] concerns about Seresto in emails."
- Another EPA staff member wrote, after seeing media articles that investigated the Seresto collar, "I hope this time someone can blow the lid off this travesty."

Ms. Burd of CBD called the email exchanges "disturbing," and said they raise further concerns about EPA's scientific integrity and transparency. She commented, "You'd think the EPA would spring to action in response to these troubling reports. But these emails tell the story of an agency focused more on saving face than saving animals. . . . The heartbreaking tragedy is that behind each and every incident report is a story of very real pet suffering, from violent seizures, rashes, and hair loss to gastrointestinal problems and even deaths."

In addition, Ms. Burd has pointed to a systemic issue with EPA's pesticide incident reporting system—the lack of any mandate for follow-up action. Although there are, she says, tens of thousands of incident complaints on record, "There's no automatic trigger for any action. It's just like, okay, you told us, thank you so much, and that's it. . . . Every time there's an incident, it's going into a black box." This represents to her a bigger worry about EPA failure to report adverse pesticide impacts generally.

These internal email revelations are further and unfortunate evidence of the

state of EPA function in carrying out its fundamental mission "to protect human health and the environment"—which for EPA's Office of Pesticide Programs, would mean protection from the broadly damaging impacts of synthetic pesticides. Beyond Pesticides has chronicled EPA's "capture" by industry influence and the corruption that has marked both agrichemical industry behavior and, occasionally, internal EPA actions, as well as specific instances of EPA failures, such as those (like the pesticide pet collars) that put children at risk, and those that continue to allow devastation of critical species (such as pollinators), critical ecosystems, and fragile habitats.

What to do: The public can learn more about keeping pets healthy through alternative management of pests with Beyond Pesticides' Keeping Our Companions Safe web page, which offers multiple strategies. One suggestion that stands out, for those who may want to continue having pets treated with flea and tick products, is to have that done at the veterinarian's office, thus, not needing to keep and dispense them in the home, and then monitoring pets for any adverse reactions.

For more on EPA functioning and how to influence critical reforms to how the agency does—or does not—enact its mission, see Beyond Pesticides' advocacy piece from November 2021, "EPA and Congress Must Act to Correct a Failed Pesticide Program." Please consider taking to heart the reforms suggested, and contacting your U.S. Senators and Representative, as well as EPA directly, with your endorsement of them.

SOURCES: Crunden, E.A. "Fiery emails show EPA turmoil over pet collars tied to deaths," Greenwire. March 25, 2022; Taft, Molly. "Seresto Flea Collars Linked to Dog and Cat Deaths Have Scientists Livid with the EPA," Gizmodo. March 28, 2022

FLEA COLLAR BANNED | OCTOBER 19, 2022

Over a Decade and Countless Children Poisoned, EPA Bans Hazardous Flea Collar Products

Pet flea collars containing the insecticide tetrachlorvinphos (TCVP) are set to be banned by the U.S. Environmental Protection Agency (EPA), according to the agency's long overdue response to a petition from the Natural Resources Defense Council (NRDC). The highly toxic pesticide has not been used on crops since 1987, yet was permitted for decades in flea collars where children could be intimately exposed to the chemical while petting and playing with the family pet. The decade-long process of bringing use of these products to an end exposes the failures of the U.S. pesticide regulatory system, and how federal pesticide law and EPA permit a marketplace filled with hazardous products. One may ask: How many veterinarians prescribed these dangerous flea collars to pet owners, assuming

that EPA has properly assessed exposure risks to their human owners? Advocates concerned about EPA's ongoing propensity to defer to the pesticide industry are urging an overhaul of the regulatory process and a reorientation toward toxic pesticide elimination and the adoption of organic in order to address serious health and environmental threats.

NRDC originally filed its petition to ban all uses of TCVP in 2009. The petition noted that the agency completely neglected to include exposures from pet collars in its risk assessment for residential uses of the chemical, despite finding that pet collar uses represent the highest level of exposure for adults. It further explained that EPA's review of risks to toddlers were flawed, and significantly underestimated their exposure. Specifically, the agency assumed that toddlers only interacted with one treated pet per day, for no more than one hour a day. EPA also ignored the potential for a toddler to touch food or another object with pesticide-contaminated hands, and then place that food or object in their mouth. Further, testing from NRDC contradicted EPA's assertion that exposure risks from TCVP pet collars were "insignificant," finding that residue levels found on pets exceeded the dose considered safe by the agency.

Despite strong evidence of flawed science, the agency denied NRDC's petition in 2014. A petition for review was filed and EPA requested a voluntary remand of its denial, which the court granted. Rather than investigate the specific issues raised by NRDC in its original petition, the agency explained it would incorporate new risk mitigation measures into its risk assessment for TVCP, and in 2017 proceeded to reregister all uses of the chemical. In doing so, the agency noted label precautions it said would protect pet owners, including not allowing children to play with TVCP collars, keeping TCVP out of the reach of children, and washing hands after handling. Advocates at the time noted how these precautions fly in the face of reality, as they suggest a scenario where kids must be prevented from petting and coming in close contact with a family dog or cat.

Another legal challenge was filed in 2019, aimed at forcing the agency to respond. After ten years, the agency required TCVP's major manufacturers to provide data specifically on the release of TCVP from pet collars. A review of that data resulted in minimal mitigation measures, and ultimately, the agency denied the petition.

NRDC again challenged this decision, noting that EPA's analysis of the new test on the release of TCVP from pet collars was miscalculated and significantly underestimated exposure risks. "EPA's 2020 risk analysis was profoundly flawed in its approach and conclusions. It has needlessly delayed the removal of these dangerous products and further exposed millions of children to serious, life-long health risks," said Miriam Rotkin-Ellman, NRDC senior scientist. In April of this year, a federal court agreed with the group, vacated the denied petition yet again, and required EPA to provide a response by October 11, 2022.

In its latest response granting the cancellation request, the agency explains that a reevaluation of the data submitted for the 2020 assessment finds that it did not "adequately assess the physical form (liquid or dust) of TCVP released from the pet collars." At the same time, however, the agency explains that it is still waiting on outstanding data from manufacturers that may impact its decision and is retaining all other use of TCVP on the marketplace, including liquid and dust products intended for use on dogs and cats. "Other types of TCVP exposures, including residues on food, also pose worrisome health risks, particularly in combination with exposure from pet products, said Ms. Rotkin-Ellman. "EPA must act swiftly to prohibit other dangerous uses of this toxic pesticide. The health of our families can no longer wait."

TCVP and other organophosphates in its class work by inhibiting the enzyme acetylcholinterase. Inhibition leads to the accumulation of acetylcholine and ultimately toxicity to the central and peripheral nervous system. Insects are killed through this mechanism, yet with humans such toxicity can cause numbness, tremors, nausea, incoordination, blurred vision, difficulty breathing or respiratory depression, and slow heartbeat. Risks are most pronounced for young children, who have developing organ systems and take in more of a pesticide relative to their body weight than adults. In calling for a ban on all organophosphate use in the U.S., scientists noted how even low-level exposures to organophosphates put children at risk of neurodevelopmental disorders, and cognitive and behavioral deficits. A study published in 2020 shows the real-world effect of these risks. It finds that organophosphate pesticide exposure results in an estimated 26 million lost IQ points and 110,000 cases of intellectual disability, totaling roughly $735 billion in economic costs to society based on data beginning in 2008.

EPA's characteristic response to nonprofit groups critiquing its science stands in stark contrast to how it responds to industry groups doing the same. When it comes to protecting health and the environment, the agency drags its feet, strongly challenges criticism, and requires public interest groups to fight for years in the courts to implement critical protections. The fight over a different organophosphate, chlorpyrifos, is another example of this. In finally forcing EPA's hand on chlorpyrifos, a federal court ruling took the agency to task, asserting, "The EPA has had nearly 14 years to publish a legally sufficient response to the 2007 Petition [filed by environmental and farmworker groups]. During that time, the EPA's egregious delay exposed a generation of American children to unsafe levels of chlorpyrifos."

Yet when the industry challenges EPA, the agency almost invariably capitulates. With the chemical paraquat, EPA allowed an industry umbrella group dubbed the Agricultural Handler Exposure Task Force to correct its data risks posed to workers, resulting in the agency changing its position within months. With the synthetic pyrethroid class of insecticides, EPA allowed an industry group to rework its methodology for

addressing pyrethroid risks to children, and followed the request of another industry group to allow the pyrethroids to be sprayed with smaller buffer zones during windier conditions. With the chemical glyphosate, despite overwhelming evidence of its carcinogenic properties, the agency has refused to acknowledge this risk, even after a federal court chastised its review process, and instead has acted on the behest of chemical manufacturers to stop glyphosate from being banned in other countries.

With federal protections consistently failing U.S. residents by harming their health and the environmental on which they all rely, while contributing to outsized corporate profits, concerned residents can still join together to push for change.

What to do: Join Beyond Pesticides in supporting changes to our pesticide laws by urging your Senators to cosponsor Senator Cory Booker's (D-NJ) *Protect America's Children from Toxic Pesticides Act,* and take further action to reform our toxic and no longer functioning federal pesticide regulatory system. For more information on the risks pesticides pose to pets and how to address flea and tick problems without toxic pesticides, see Beyond Pesticides' Pets and Pesticides program page.

SOURCE: Messina, Ed. U.S. Environmental Protection Agency. "Agency Response to the Natural Resources Defense Council (NRDC), April 2009 Tetrachlorvinphos Petition." October 2022; NRDC press release and TCVP case documents

REGULATIONS CONTINUE TO FAIL POLLINATORS | MAY 9, 2022

With Decision on Insecticide, EPA Betrays Protection of Pollinators . . . Again

While the U.S. Environmental Protection Agency (EPA) updated its guidelines for pollinator risk assessment in 2014, the agency continues to either fail to conduct full assessments, or dismiss concerning data it receives. EPA appears to discount threats like the insect apocalypse, evidenced by a 75% decline in insect abundance, which threatens not only global ecosystems, but also food production that depends on animal pollination. As pesticides move through the food web, birds are also at risk. Bird numbers are down 29% since Rachel Carson wrote *Silent Spring* in 1962.

The problem is highlighted by EPA's recent Interim Decision on fenbuconazole, in which the agency notes that, "For larval bees, RQs (risk quotients) exceed the LOC (level of concern) for all pollinator attractive uses including when assessed at the lowest application rate of 0.0938 lbs a.i./Acre (RQ = 1.1)." Yet in the same document, the agency declares that "…the benefits of fenbuconazole (e.g., efficacy in management of fungal pathogens) outweigh any remaining risk and that continuing to register fenbuconazole provides significant

benefits, including its ability to increase crop yields and help with resistance management." While the agency added additional restrictive language on spray drift, it implemented no new precautionary measures for pollinators. The agency continues to fail pollinators, farmers, and the public.

Exposure to this commonly used fungicide considered to be 'slightly toxic or nontoxic' to pollinators makes male mason bees less likely to find a mate, jeopardizing future generations of critically important pollinators. This determination comes from research recently published in the *Journal of Applied Ecology* by scientists at Germany's University of Würzburg. The timing of these findings comes after the EPA re-approved uses of fenbuconazole late last year without completing all required studies on pollinator health effects.

EPA's action on fenbuconazole follows other actions by the agency that threaten pollinators, such as neonicotinoid (neonic) insecticides. Despite EPA's own findings of evidence of serious threats posed by neonics to pollinators, aquatic invertebrates, and other wildlife, it issued interim decisions on them in January 2020 that disregard the science on the pesticides' impacts and it appears that the agency is prepared to finalize these registrations late in 2022. This would, barring further action, extend the use of these harmful compounds *for 15 years*.

EPA's history of unenforceable and impractical pesticide label restrictions resulting in findings of ludicrously small or no risk continues with its announcement that allows the continued use of the deadly organophosphate insecticide malathion—another example of a federal agency falling far short, as the nation and world sit on the brink of biodiversity collapse and deadly pesticide-induced diseases. Malathion poses a threat to 97 percent of species listed under the *Endangered Species Act*, including Kirtland's Warbler and Black-capped Vireo. Bats, who are valuable pollinators, insectivores, and seed dispersers, are at high risk from pesticide exposure.

After registering over 300 products containing synthetic pyrethroid pesticides within the last six years, EPA has done nothing to safeguard endangered species from exposure to these toxic chemicals, despite a legal requirement to do so.

After registering over 300 products containing synthetic pyrethroid pesticides within the last six years, EPA has done nothing to safeguard endangered species from exposure to these toxic chemicals, despite a legal requirement to do so. Synthetic pyrethroid insecticides are synthesized derivatives of pyrethrins, which compared to their natural counterpart take significantly longer to degrade in the environment and thus pose longer term risks to humans and wildlife. The chemicals interfere with the proper function of the body's sodium channels, resulting in harm to the central nervous system. Symptoms of poisoning include headache, nausea, incoordination, tremors, and facial swelling, with severe incidents causing diarrhea, convulsions, paralysis, and death. "The EPA admits pyrethroids' wide-ranging harm to wildlife but still rubberstamps hundreds of pesticide products containing them without assessing their risks to endangered species," said Lori Ann Burd, environmental health director at the Center for Biological Diversity.

Letter to U.S. Environmental Protection Agency:

While EPA updated its guidelines for pollinator risk assessments in 2014, the agency continues to either fail to conduct full assessments or dismiss concerning data it receives. EPA appears to discount threats like the insect apocalypse, evidenced by a 75% decline in insect abundance, which threatens not only global ecosystems, but also food production that depends on animal pollination. As pesticides move through the food web, bird numbers are down 29% since Rachel Carson wrote *Silent Spring* in 1962.

The problem is highlighted by EPA's recent Interim Decision on fenbuconazole, in which the agency notes that, "For larval bees, RQs (risk quotients) exceed the LOC (level of concern) for all pollinator attractive uses including when assessed at the lowest application rate of 0.0938 lbs a.i./Acre (RQ = 1.1)." Yet in the same document, the agency declares that "…the benefits of fenbuconazole (e.g., efficacy in management of fungal pathogens) outweigh any remaining risk and that continuing to register fenbuconazole provides significant benefits, including its ability to increase crop yields and help with resistance management." While the agency added additional restrictive language on spray drift, it implemented no new precautionary measures for pollinators. With the only indications that this chemical is dangerous to pollinators deep in EPA's dense review documents the public rarely if ever reads, the agency continues to fail pollinators, farmers, and the public.

Exposure to this commonly used fungicide makes male mason bees less likely to find a mate, jeopardizing future generations of critically important pollinators, according to research published in the *Journal of Applied Ecology* by scientists at Germany's University of Würzburg. These findings come after the EPA reap-

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proved uses of fenbuconazole late last year without completing all required studies on pollinator health effects.

EPA's action on fenbuconazole follows actions on other pesticides that threaten pollinators, such as neonicotinoid (neonic) insecticides. Despite EPA's own findings of evidence of serious

threats posed by neonics to pollinators, aquatic invertebrates, and other wildlife, interim decisions in January 2020 disregard the science on the pesticides' impacts, and it appears that the agency is prepared to finalize these registrations late in 2022, extending the use of these harmful compounds *for 15 years*.

EPA's history of unenforceable and impractical pesticide label restrictions resulting in findings of ludicrously small or no risk continues with its announcement that allows the continued use of the deadly organophosphate insecticide malathion—another example of an irresponsible federal agency falling far short, as the nation and world sit on the brink of biodiversity collapse. Malathion poses a threat to 97 percent of species listed under the *Endangered Species Act*, including Kirtland's Warbler and Black-capped Vireo. Bats, who are valuable pollinators, insectivores, and seed dispersers, are at high risk from pesticide exposure.

After registering over 300 products containing synthetic pyrethroid pesticides within the last six years, EPA has done nothing to safeguard endangered species from exposure to these toxic chemicals, despite legal requirement to do so. The chemicals interfere with channels, harming the central nervous system.

To help avert ecosystem collapse, EPA must complete pollinator assessments and ban pesticides, shown to imperil populations of insects and other pollinators.

Letter to U.S. House of Representatives and Senate:
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done nothing to safeguard endangered species from exposure to these toxic chemicals, despite legal requirement to do so. The chemicals interfere with the proper function of the body's sodium channels, resulting in harm to the central nervous system.

To help avert ecosystem collapse, please ensure that EPA completes pollinator assessments and bans pesticides, including fungicides, insecticides, and herbicides, shown to imperil populations of insects and other pollinators.

What to do: See Beyond Pesticides' Bee Protective web page for additional actions you can take.

SOURCE: U.S. Environmental Protection Agency. "How We Assess Risks to Pollinators." https://www.epa.gov/pollinator-protection/how-we-assess-risks-pollinators; U.S. EPA. "Guidance for Assessing Pesticide Risks to Bees." June 19, 2014.

FUMIGANT HAZARD REVIEW CORRUPT | JULY 26, 2022

Inspector General Finds Secret EPA Meetings with Industry and Use of Untested Science to Lower Cancer Risk for Dangerous Fumigant

Secret meetings with industry, the elevation of unqualified individuals to decision-making roles, using an untested scientific approach, failing to conduct a simple literature review, and an overall absence of public transparency. This is how the U.S. Environmental Protection Agency's (EPA) conducted its cancer review for the potent fumigant pesticide 1,3-Dichloropropane (1,3-D; brand name: Telone), according to a report from EPA's Office of Inspector General (OIG). EPA's actions allowed a product once considered to pose a 1 in 10,000 risk of cancer to Americans to increase exposure by 9,000% (from 7.7 µg/m3 to 690 µg/m3). "These departures from established standards during the cancer assessment for 1,3-D undermine the EPA's credibility, as well as public confidence in and the transparency of the Agency's scientific approaches, in its efforts to prevent unreasonable impacts on human health," the OIG report states. Yet, even with the agency's failings laid out in clear view, EPA's lackluster response to OIG's corrective actions in this case adds insult to its injurious actions against public health.

OIG initiated a review of EPA's cancer assessment for 1,3-D after the submission of multiple complaints. 1,3-D is a highly toxic fumigant used on a variety of crops, but primarily on potatoes, tobacco, strawberries, peanuts, and tomatoes to manage nematode pests in soils. The chemical has increased in use by roughly 40% over the last 20 years, with almost 37 million pounds used on 300,000 acres across the United States each year. EPA first classified 1,3-D as "likely to be carcinogenic to humans" in 1985. The chemical retained that designation until the primary manufacturer, Dow Chemical Company (recently transferred to a subsidiary called Salt Lake Holding LLC), requested EPA conduct the current cancer reevaluation. EPA review resulted in 1,3-D being downgraded from "likely" to "suggestive evidence of carcinogenicity."

As part of this new evaluation, a Cancer Assessment Review Committee (CARC) within EPA's Office of Pesticide Programs is tasked with determining whether to update a chemical's cancer classification. The process is relatively straightforward, and includes a literature search, statistical analysis, draft review, CARC vote and final posting on the pesticide's review docket. Yet, OIG found a range of serious discrepancies from the start.

One of the most basic steps—searching the open scientific literature for relevant studies on the chemical—was not properly conducted. While EPA searched for "1,3-D" and "Telone," the full chemical name "1,3-Dichloropropene" was not included, and no one raised a red flag when only eight search results were found. OIG notes that EPA rejected consideration of all eight of these studies, and did not provide a reason, failing to follow its own

guidelines. "Therefore, the OPP should have provided the rationale and methodology for excluding each study in 1,3-D's draft human health risk assessment, but it did not," the report notes.

In addition to this basic failing, EPA utilized a novel approach to evaluate 1,3-D's carcinogenicity. Rather than following a process in place since 1978, EPA utilized an untested scientific approach outside of EPA's guidance documents. At issue is how to determine the highest exposure that can occur without harming an animal long-term or causing other non-cancer effects. This value allows scientists to determine a pesticide's carcinogenicity. Rather than the traditional maximum-tolerated-dose approach, EPA utilized an approach called kinetically-derived maximum dose (KMD).

This method is so new that without guidance determining how EPA applies the information it analyzes, third parties have no way to independently evaluate EPA's determinations. OIG notes that even after EPA applied the approach, it has participated in symposiums questioning the value of the KMD and noting its rarity in assessments. Independent scientific literature has a range of assessments on this method, with one recent study including a recommendation "to abolish the KMD concept for selecting top doses in toxicity testing."

Not only did EPA apply a novel process to evaluating the carcinogenicity of 1,3-D, OIG interviews with EPA CARC officials reveal that members lacked knowledge on how to implement the KMD approach. "Some believed that not all members possessed the appropriate scientific expertise for using and implementing the KMD approach for evaluating the evidence of the carcinogenic potential of 1,3-D," the report indicates.

OIG notes that "novel, precedent-setting, or controversial influential scientific information" by the agency should be subject to external peer review. The report quotes from EPA's own guidelines which explain that novel scientific procedures can "undercut the scientific credibility of a risk assessment."

Beyond the nuts and bolts of the opaque process that OIG was able to reconstruct lies the failure of EPA officials to record meetings with the chemical's primary manufacturer. Between 2016 and 2018, as EPA was in the midst of its cancer review for 1,3-D, officials met with Salt Lake Holding LLC/Dow Agrosciences at least five times. "No information from these meetings appeared in the pesticide-registration review docket, even though some of these meetings included discussions on the application of KMD for the 1,3-D cancer assessment," the report reads.

EPA claims that its cancer-related meetings were not required to go on the pesticide's registration review docket because those actions are separate. OIG rejected that argument out of hand, referencing the fact that EPA incorporated the cancer determination into its review documents.

At the end of its report, OIG made nine recommendations for corrective action by EPA. The agency accepted the recommendation to update the document with past meeting information, and issue guidance to clarify when meetings are reported to the docket. It also agreed to update CARC's standard operating procedures, take steps to ensure individuals with the appropriate expertise are represented at each CARC meeting, and that the committee is regularly monitored and assessed to ensure it is following internal standards. EPA agreed with OIG over the need to require external peer review of risk assessments using novel approaches that set precedent for future risk assessments.

EPA also agreed to reconduct a comprehensive literature search on 1,3-D. Yet, the review conducted exemplifies EPA's attitude both before and after the OIG report. In a corrected memo published the 1,3-D's docket, EPA ascribes the mistake to a "transcription error." Despite OIG finding over 100 studies, EPA explains that "no changes were necessary or made to our analysis or conclusion." Rather than corrective, this response continues the agency's disdain for independent, peer-reviewed literature in favor of untested, novel approaches influenced by industry without any external peer review.

The recommendations EPA rejected from OIG bring this disdain into sharp relief. EPA rejected the idea that KMD represented a novel approach, and indicated the information was used merely to "interpret" tumor findings in mouse carcinogenicity studies. EPA is thus refusing to issue guidance on how to conduct KMD analysis, and instead proposed to link to a non-EPA, third-party website for guidance. OIG rejected this proposal and considers its recommendation for EPA to issue its own guidance unresolved.

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EPA also rejected OIG's recommendation to conduct an external peer review of the 1,3-D cancer risk assessment. The agency's reasoning? That "the external peer review sponsored by the registrant meets the intent of the recommendation to conduct an external peer review." In other words, EPA is indicating that the review conducted by Dow Agrosciences for a chemical it intends to sell for profit is an acceptable form of peer review. OIG's response is as follows: "While the registrant-sponsored peer review appears to have many similarities to a peer review that would be conducted by the FIFRA Scientific Advisory Panel, it lacks specific elements—such as independence from the regulated business, a preparatory public meeting to consider the scope and clarity of the draft charge questions

for the peer review, an opportunity for written public comments to be considered by the peer review, and public participation for oral comments during the peer review meeting. These elements are needed to improve the transparency and scientific credibility of the 1,3-D cancer-assessment process. Thus, Recommendation 8 is unresolved."

EPA's response to being caught playing fast and loose with a highly carcinogenic chemical shows that no lessons are being learned. Advocates are fed up with EPA's behavior, as it perverts its mission to comply with as little as possible to protect public health while continuing to satisfy industry stakeholders and their executive compensation. "These are not honest mistakes but carry the earmarks of deliberate malfeasance," stated Tim Whitehouse, executive director of Public Employees for Environmental Responsibility (PEER) and a former EPA enforcement attorney, noting that this fits a pattern of industry manipulation of EPA's chemical regulation process. "This example of misconduct is egregious but, unfortunately, is not isolated." PEER and other advocates raised the alarm about 1,3-D, and were joined in their concern by eight Attorney's General, which urged EPA to revise its health risk assessment for 1,3-D.

While EPA continues to function as a protective agency in many other areas, advocates say the agency is not just failing, but antagonistic to its mission to protect public health and the environment from toxic pesticides.

For those that may consider this issue outside of their concern, note that a recent study focusing on the Western United States determined fumigant pesticides to be the class of chemicals most closely linked to county-level cancer rates. Regarding the cancer connection to fumigant use, study co-author Naveen Joseph, PhD, University of Idaho noted, "We have not seen it expressed in a fumigant like this before, and it's absolutely striking."

EPA was recently cited by a federal judge for its dangerously inept cancer review of glyphosate, holding that EPA unlawfully concluded that glyphosate does not pose a cancer risk. The court criticized EPA for its "disregard of tumor results;" its use of "bare assertions" that "fail . . . to account coherently for the evidence;" making conclusions that do not "withstand . . . scrutiny under the agency's own framework," and "fail[ing] to abide by" its own cancer guidelines. In sum, the court notes EPA's "inconsistent reasoning" made its decision on cancer "arbitrary," and struck it down. The agency has a long history, such as with the synthetic pyrethroids, of uncritically accepting industry-created health models over those time-tested by peer-reviewed science.

What to do: It is time for meaningful change to our federal pesticide laws. While EPA continues to function as a protective agency in many other areas, advocates say the agency is not just failing, but antagonistic to its mission to protect public health and the environment from toxic pesticides. To remedy this, industry influence within the Office of Pesticide Programs must be rooted out. Only through pressure on our public officials can this occur. Tell your Senators to support needed reforms to EPA through the *Protect America's Children from Toxic Pesticides Act* and *Saving America's Pollinators Act*.

SOURCE: Office of Inspector General, U.S. Environmental Protection Agency. *The EPA Needs to Improve the Transparency of Its Cancer-Assessment Process for Pesticides*, Report No. 22-E-0053, July 20, 2022; PEER press release

FEDERAL BILL TO WEAKEN PESTICIDE RESTRICTIONS | JULY 29, 2022

With Industry Support, a Republican U.S. Senator Introduces Bill to Codify Easier Access to Ag Pesticides–As If It Wasn't Easy Enough

Perhaps attempting to capitalize on the recent U.S. Supreme Court decision limiting the U.S. Environmental Protection Agency's (EPA's) ability to regulate carbon emissions, U.S. Senator Roger Marshall of Kansas (R) has filed a bill in the Senate that seeks to limit the agency's ability to regulate pesticide use. The so-called *EPA Transparency for Agriculture Products Act of 2022* is touted, on Senator Marshall's website, as "a comprehensive bill to prevent . . . EPA . . . from overregulating essential pesticides that the ag industry heavily depends upon." In truth—and perversely, given that he is a medical doctor—the bill aims to provide *more* license to use toxic pesticides that harm human health, the environment broadly, and ecosystems already under assault from toxic, synthetic pesticides and fertilizers, habitat destruction, and climate change.

Couched in language about "feeding the world," the bill's central concern seems to be financial impacts or challenges that farms (a good portion of which are giant, well-resourced agribusinesses) may face because of EPA pesticide regulations. Those regulations, of course, are promulgated by the agency to protect people, organisms, ecosystems, and natural resources from harmful impacts and risks from pesticide use (however well or poorly the agency manages to do that for specific pesticides).

The bill purports to "ensure pesticide registrations and rulemaking is (sic) based on proven science." What it appears to do is throw monkey wrenches into EPA's processes. How? By giving agro-industrial interests more rein and weight; by inserting economic considerations into EPA's review processes (NB: this is not part of the agency's mission or charge); by pulling into review processes "input" from other federal agencies; by dragging out effective dates of regulatory action; and by setting short deadlines for registration reviews, i.e., telling EPA it cannot employ more than two 60-day extensions for review of a label or labeling change, and then making approval of any such label automatic if EPA fails to take action on it before the final deadline (functionally, the end of 120 days of extension).

Among the bill's overreaching features is a requirement that the director of the federal Office of Management and Budget (OMB) conduct an "interagency review of any proposed interim, interim, or final registration decision regarding nonvoluntary, more restrictive changes to a pesticide label under a registration review." Another is stringing out the effective date by which an interim or final registration decision (issued as part of a registration review of nonvoluntary, more restrictive changes to a pesticide label, including a revocation or cancellation of a registration) shall take effect to "one year after the date on which the interim decision or final decision, as applicable, and any comments submitted by the Secretary of Agriculture, are published in the Federal Register."

Further, the bill wants to make EPA use industry data as part of its basis for registration review processes: "The Administrator shall base any decision issued as part of the registration review process on Department of Agriculture agronomic use data, *commercially available agronomic use data, and industry agronomic use data*" [emphasis by Beyond Pesticides].

The bill also seeks to constrain judicial purview over cases involving pesticides:

- In issuing a decision that would result in more restrictive changes to a pesticide label, including a revocation or cancellation of a registration, the court shall allow the continued use of the registration through the following growing season.
- Before issuing a decision that would result in more restrictive changes to a pesticide label, including a revocation or cancellation of a registration, the court shall conduct a *de novo* review to determine whether there is a viable and affordable alternative to control the same target pest.

This bill would add to a section of FIFRA (the *Federal Insecticide, Fungicide, and Rodenticide Act*, the statute that governs the registration, distribution, sale, and use of pesticides) to mandate that the Agriculture Science Committee of EPA's Science Advisory Board "review any decision or advice issued by the Scientific Advisory Panel (A) to determine whether the decision or advice would have an economic impact of more than $100,000 on the agricultural industry; and (B) if the decision or advice would have an economic impact of more than $100,000 on the agricultural industry, to consider and describe that economic impact."

Any change could reach the $100,000 level of impact, given that there are approximately two million farms in the country, as well as all the adjunct businesses.

Senator Marshall extolled the bill on his website, saying, "At a time when Kansas' farmers and ranchers are coping with record inflation and broken supply chains, the last thing they need

is the EPA revoking or severely limiting traditional farming tools and methods. Access to safe, effective pesticides is vital for allowing farmers to continue to efficiently and sustainably feed, clothe, and fuel the world."

To approximately no one's surprise, agrochemical and agro-industrial groups were immediately "all in" on this bill, and fell over themselves offering glowing commentary for use by the Senator on his website.

A few examples:

- The president of the Kansas soybean association said, "It's simple, farmers need critical crop protection tools like glyphosate to feed the world. Farmers use it on 40% of all acres in the US and it enables more than $50 billion dollars of production annually. We appreciate this bill that will provide farmers with continued access to these and other crop protection tools prospectively."
- The CEO of the Kansas Corn Growers Association offered this: "EPA is using regulatory tricks to drastically limit farmers (sic) use of critical inputs like Atrazine. A recent proposal would restrict its use on corn in almost all of Kansas leaving no cost-effective way to control herbicide resistance. EPA should refocus its attention on sound science and transparency is key to that."
- The president of the Kansas Agribusiness Retailers Association and CEO of the Kansas Grain and Feed Association said, "Thank you, Senator Marshall for standing at the forefront in defense of our nation's farmers who depend on these indispensable crop protection products allowing them to reliably feed, fuel and clothe the world."

Prior to filing this bill, the Senator was involved in a Zoom call in January with EPA Administrator Michael Regan and other agency officials to "discuss the problematic direction EPA is head (sic) with decisions that restrict access to safe and necessary crop protection products." In February, he and other conservative Senators (Chuck Grassley of Iowa, Mike Braun of Indiana, and Joni Ernst of Iowa) sent a letter to EPA Administrator Regan that called on him "to redirect the EPA's Office of Pesticide Programs away from their current propensity for overly precautious, blanket bans and severe restrictions of necessary crop protection tools back towards a regular, risk-based regulatory process." They specifically advocated for more lax regulation of chlorpyrifos, dicamba, glyphosate, and triazine herbicides (such as atrazine and simazine)—all very toxic and problematic pesticides for human and environmental health—and criticized EPA's approach to Biological Evaluations required under the *Endangered Species Act*.

In a May 2022 hearing in the Senate Committee on Agriculture, Nutrition, and Forestry, Senator Marshall stressed to U.S. Department of Agriculture Secretary Tom Vilsack his insistence on the importance of the "crop protection" herbicide glyphosate; he urged Sec. Vilsack to "stand up to the Environment Protection Agency's position on glyphosate that will restrict farmers' access to the pesticide." Then, in June 2022, Senator Marshall and conservative Republican Senators Cindy Hyde-Smith of Mississippi, Thom Tillis of North Carolina, Roger Wicker of Mississippi, and James Lankford of Oklahoma sent a letter to President Biden calling on him to "defend" glyphosate and other pesticides.

The Senator and his colleagues appear, through this bill, to want to reduce significantly the constraints and limits on pesticide regulation. In placing conventional agriculture's "need" for toxic pesticides at the heart of this bill and above the well-being of people and the natural world, the Senator betrays not only disregard for that well-being, but also, a distinct lack of understanding of the broader agricultural universe in the U.S.

As Beyond Pesticides Executive Director Jay Feldman has pointed out, "The information on 'need' comes from those who are dependent on chemical-intensive management practices and, in fact, have established management practices that increase dependency over time. On the other hand, the fact that there is a burgeoning organic market not reliant on toxic chemicals does not seem to factor into the calculation of 'need.' The bottom line is that there has to be a concerted and affirmative effort to wean agriculture from its toxic chemical dependency if this country is going to protect people and Nature from health threats, biodiversity collapse, and the climate emergency. This legislation takes us in the wrong direction and leads us down a path with dire consequences. We should be making it more difficult to use fossil-fuel-based, toxic chemicals in agriculture, not easier."

Beyond Pesticides has written about the relationship between the climate emergency and the toxic chemical (and plastic) pollution crisis here and here. Advancing a livable future requires a rapid realignment on both the toxics and climate fronts. Senator Marshall—who is an obstetrician/gynecologist, so one might think he would have a sense of the devastating impacts pesticides can have on a developing fetus—appears ignorant, willfully or otherwise, of these realities. The Senator, who refers to himself on his website as "Doc Marshall," has perhaps forgotten the oath he took as a medical student, one of the promises of which is *primum non nocere*—first, do no harm.

Secretary General of the United Nations, António Guterres, recently captured the stakes: "We have a choice. Collective action or collective suicide. It is in our hands." One is hard pressed not to conclude that the Senator and his Republican compatriots—inexplicably favor the latter choice.

What to do: Advocate for the *Protect America's Children from Toxic Pesticides Act* and begin a campaign in your community for converting land management to organic practices. See Parks for a Sustainable Future and contact Beyond Pesticides at info@beyondpesticides.org.

SOURCES: Marshall, Roger. U.S. Senate. "New Sen. Marshall Bill Aims to Maintain Availability of Vital Crop Protection Tools." Press Release. July 21, 2022; Motter, Sarah. "New bill ais to safeguard pesticides for farmers from the EPA." WIBW. July 21, 2022

EPA IGNORES INDOOR CONTAMINATION WITH DISINFECTANTS | OCTOBER 21, 2022

While Allowing Indoor Pesticide Spray for Covid, EPA Seeks Advice on Improving Indoor Air Quality

The U.S. Environmental Protection Agency (EPA) has just made two announcements, related to the quest for improved indoor air quality in buildings, that address mitigation of disease transmission—and that of Covid-19, in particular. Related to enactment of the *National Covid-19 Preparedness Plan*, EPA issued guidance on the efficacy of antimicrobial products used on surfaces, and registered a new pesticide product the agency says can be used against influenza and corona viruses (some of the latter cause Covid-19 infections). In addition, EPA opened a 60-day public comment period "to solicit information and recommendations from a broad array of individuals and organizations with knowledge and expertise relating to the built environment and health, indoor air quality, epidemiology, disease transmission, social sciences and other disciplines." Beyond Pesticides cannot help but note the irony of an intention to improve air quality that EPA couples with registration of a new, airborne pesticide for indoor use.

EPA expands on its RFI (Request for Information) related to indoor air quality, saying that it is "seeking input from a diverse array of stakeholders . . . about actions, strategies, tools and approaches that support ventilation, filtration and air cleaning improvements, and other actions that would promote sustained improvements in indoor air quality in the nation's building stock to help mitigate disease transmission."

EPA provided interim guidance in 2020 on products that look to claim residual efficacy (ability to continue killing pathogens beyond immediate application). The new guidance identifies three categories of such products: (1) residual disinfectants, (2) antimicrobial surface coatings and films, and (3) fixed/solid surfaces, such as copper, or other impregnated materials. The "residuals" are standard disinfectants that generally show efficacy for up to 24 hours after application; the other two categories represent newer approaches for which EPA now requires a "stewardship plan" in order to gain (conditional) registration. In addition, the agency has issued guidance on new antimicrobial testing methods and standard procedures for evaluation of efficacy of disinfectants on hard surfaces again specific viruses and bacteria.

EPA's October 6 registration announcement asserts that the newly registered pesticide, Lysol Air Sanitizer spray, is the first registered antimicrobial product that can kill both viruses and bacteria. EPA explains the utility of the new product: "When users spray the aerosol product in a closed, unoccupied room in accordance with the label use-directions, Lysol Air Sanitizer can kill bacteria and viruses in the air." The product will reportedly kill 99.9% of airborne viruses when all doors, windows, air vents, and air returns in the room are closed, the product is sprayed for 30 seconds,

and the room left empty and closed up for 12 minutes. Product instructions do note that there is "no residual effect after room is reopened." Given that last proviso, the practicality of such a product may be somewhat limited, but *Inside Energy and Environment* opines that it "may pave the way for other types of registered pesticides that kill airborne viruses and bacteria." EPA has a history of registering fumigants, such as sulfuryl fluoride, and indoor sprays that leave residues in closed spaces and structural voids in the indoor environment, despite claims that ventilation clears the poison. In terms of efficacy, airborne viruses are being constantly introduced and reintroduced in public spaces, such as stores, schools, restaurants, and public spaces. So, in this public context, a sanitizer application to an indoor space only protects against the target virus as long as the building is not used by the public.

The active ingredient in Lysol Air Sanitizer spray is dipropylene glycol (DPG), an ingredient used in some cosmetics. The Environmental Working Group's Skin Deep database considers it a generally low-risk compound, but has limited data available on the chemical; the web page also indicates that health risks can be greater if DPG is used in an inhalable form, which the Lysol product obviously deploys. EPA's review finds low acute inhalation toxicity of DPG, but that assessment is based on studies of mostly acute, not chronic or subchronic inhalation.

The agency announcement adds that EPA "conducted a robust risk assessment on exposure from both household and commercial use. When used following label directions, this product poses no unreasonable adverse risks to human health or the environment."

Two points require emphasis:

- EPA's track record on what pesticides constitute a human health threat, and to what degree, is not stellar; consider reporting on, among other considerations, risks even with low-level exposures, potential synergistic impacts of multiple chemical exposures, and industry influence on agency risk assessments.
- Increasing numbers of people in the U.S. are reporting "chemical intolerance (CI)"—extreme sensitivity to one or more chemicals. A 2021 research study on CI reported that 15–36% of the population reports this experience and find no comfort in EPA's "no unreasonable adverse risk" finding.

As a broader category, synthetic organic chemicals and their combustion products were the primary exposures associated with chemical intolerance. Such chemicals include pesticides, peroxides, nerve agents, anti-nerve agent drugs, lubricants and additives, xylene, benzene, and acetone.

A more-recent and -comprehensive concept (and moniker) is Toxicant-Induced Loss of Tolerance, or TILT—a disease theory that joins germ theory and immune theory to describe and explain what CI people may experience. A leading researcher on TILT is Dr. Claudia Miller, an allergist/immunologist, professor emerita in the Department of Family and Community Medicine at The University of Texas Health Science Center (San Antonio), and leader of its Hoffman TILT Program. She was also a coauthor of the paper on the 2021 study referenced above, *Toxicant-induced loss of tolerance for chemicals, foods, and drugs: assessing patterns of exposure behind a global phenomenon*.

That work examines eight major exposure events that precede the onset of CI in groups of people who shared the same exposure experience. Those groups comprised, respectively: workers at EPA headquarters during renovations; Gulf War veterans; casino workers with pesticide exposures; workers with exposures to aircraft oil fumes; people who experienced the 2001 World Trade Center tragedy; people with surgical implants; those exposed to moldy environments; and tunnel workers exposed to solvents. Study findings were that "mixed volatile and semi-volatile organic compounds (VOCs and SVOCs), followed by pesticides and combustion products, were most prevalent across TILT initiation events. As a broader category, synthetic organic chemicals and their combustion products are the primary exposures associated with chemical intolerance. Such chemicals include pesticides, peroxides, nerve agents, anti-nerve agent drugs, lubricants and additives, xylene, benzene, and acetone."

Dr. Miller describes TILT: "It is a two-step process. First, initiation involves acute or chronic exposure to environmental agents such as pesticides, solvents, or indoor air contaminants, followed by triggering of multi-system symptoms by exposure to small quantities of previously tolerated substances such as traffic exhaust, cleaning products, fragrances, foods, drugs, or food-drug combinations." The 2021 study identified that, for the initiation to occur, the exposure must "interact" with the human nervous system or immune system (or both) creating intolerance to later triggering events. The coauthors assert that too little is yet known about the nature of that requisite "interaction," but clearly point to synthetic organics (e.g., pesticides) as one of several primary exposure sources.

In its coverage, Beyond Pesticides notes that, "In the second stage, affected individuals are 'triggered' even by minute exposures, not only to the chemical that affected them in the first place, but also to other chemicals that did not affect them previously." These post-acute trigger exposures can result in a range of symptoms, some fairly debilitating: chronic fatigue; gastrointestinal (GI) issues; problems with memory, attention, and/or mood; headaches or migraines; asthma; rashes; muscle pain; and/or allergy-like symptoms.

Beyond Pesticides adds, "TILT sufferers are often bounced from doctor to doctor based on individual symptoms, have significant difficulties receiving a diagnosis, and must navigate a world filled with triggering compounds, ranging

from pesticides, to fragrances, molds, and other indoor air contaminants, traffic exhaust, pharmaceutical drugs, certain food, or food and drug combinations, or other volatile compounds. . . . The [fact] of TILT undermines [the] classical toxicological concept that 'the dose makes the poison.' . . . a better phrase may be that '[the] dose plus host makes the poison,' with an understanding that past exposures and various genetic factors are likely at play in terms of individual tolerance to environmental pollutants. These factors play into why it is so difficult for affected individuals to receive treatment, let alone a diagnosis."

About these triggers, Dr. Miller points out that the tens of thousands of pesticides, petrochemicals, and plastics in our materials stream broadly expose humans in industrialized countries to compounds with which humans did not coevolve, and that roughly 20% of the populations of such countries exhibit chemical intolerances. Dr. Miller has developed diagnostic instruments to help identify patients suffering from TILT-related intolerances, including the Chemical Intolerance Self-Assessment (QEESI). For more information, read a transcript of a talk given by Doris Rapp, MD, and published in Beyond Pesticides' *Pesticides and You* newsletter, and visit the UT San Antonio website on the Hoffman TILT program. See Dr. Miller's talk at Beyond Pesticides National Forum Series, *Health, Biodiversity, and Climate: A Path for a Livable Future*.

The Hoffman program page lists, among other information, common triggers and alternatives to them. Among those triggers is the category "bleach, ammonia, disinfectants, and strong cleaning products." The alternatives offered are "elbow grease, non-toxic soap and water, baking soda, and vinegar." Great advice for general cleaning, but unlikely to seem sufficient to those looking for anti-Covid-19 "magic bullets"—an understandable desire, given the havoc this pandemic has wreaked. That said, EPA should be paying more, and more-granular, attention to vulnerable, chemically intolerant segments of the population in its review of, and risk assessments for, new pesticide products, such as this new Lysol spray. Chemically intolerant people, as individuals and as a cohort, are given far too little consideration in this regard.

Beyond Pesticides has previously published articles and fact sheets on Covid-19 protective strategies (some from early in the pandemic), including: EPA-allowed disinfectants increase vulnerability; safer personal protection: a disinfectants factsheet; and a Q&A on sanitizers and disinfectants.

What to do: Beyond Pesticides encourages responses to EPA's Request for public comments, due no later than December 5, 2022.

SOURCES: U.S. Environmental Protection Agency. Request for Information: Better Indoor Air Quality Management To Help Reduce COVID-19 and Other Disease Transmission in Buildings: Technical Assistance Needs and Priorities To Improve Public Health. EPA-HQ-OAR-2022-0794

PFAS BILL IN CONGRESS TO ADDRESS HARM | OCTOBER 28, 2022

Bill in Congress Will Pay for Treating Illness and Financial Impact Caused by PFAS

The Maine Congressional delegation—Senators Collins (R) and Angus King (I), and Representatives Chellie Pingree (D) and Jared Golden (D)—along with New Hampshire Senator Jeanne Shaheen (D), have introduced a bipartisan and bicameral bill—the *Relief for Farmers Hit with PFAS Act*—to help farmers who have been impacted by the scourge of PFAS (perfluoroalkyl and polyfluoroalkyl substances) chemicals. (The Senate version of the bill is available; the House version should be soon.) PFAS contamination has, as Beyond Pesticides documented in two articles (here and here), become a huge, life-altering problem for agricultural producers in Maine and many other states.

An early 2022 Safer States analysis of state-level legislation on PFAS demonstrated the extent of the problem via the response: more than 32 states have begun to act on the issue. Beyond Pesticides has covered the presence of PFAS in pesticides and pesticide containers, and in so-called "biosludge" or "biosolids"—realities that only reinforce the call for a rapid transition off of chemical-dependent agriculture and to regenerative organic agricultural practices that do not carry the enormous health and environmental risks of pesticide products and contaminated fertilizers.

There are more than 9,000 synthetic (human-made) chemical compounds in the PFAS family, which includes the most-well-known subcategories, PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid). These PFAS compounds, dubbed "forever chemicals" for their persistence in the environment (largely because they comprise chains of bonded fluorine–carbon atoms, those bonds being among the strongest ever created). This class of synthetic chemicals, found in drinking water, surface and ground water, waterways, soils, and the food supply, among other sources, is emerging as a ubiquitous contaminant. PFAS contamination of drinking water resources is a serious and growing issue for virtually all U.S. states, as Environmental Working Group (EWG) demonstrates via its interactive map,

and for hydrologic ecosystems around the world.

The widespread presence of these compounds arises from multiple sources:

- extensive "legacy" (historic) uses in fabric and leather coatings, household cleaning products, firefighting foams, stain-resistant carpeting, and other products
- historic and current industrial uses in the aerospace, automotive, construction, and electronics sectors
- current uses in many personal care products (e.g., shampoo, dental flosses, makeup, nail polish, some hand sanitizers, sunscreens); water-and-stain-proof and -resistant fabrics and carpeting; food packaging; and non-stick cookware, among others

Although some of these uses have been phased out over the course of the past couple of decades, many persist, including several related to food processing and packaging. The flooding of the materials stream, with thousands of these synthetic, persistent PFAS compounds since their first uses in the 1950s (notably by 3M), means that they remain widespread in the environment and in human bodies. People can be exposed to PFAS compounds in a variety of ways, including occupationally, through food sources, via drinking contaminated water (another enormous emerging issue; see below), ingesting contaminated dust or soil, breathing contaminated air, and using products that contain, or are packaged in materials that use, the chemicals.

The U.S. Environmental Protection Agency (EPA) notes on one of its web pages that, "because of their widespread use and their persistence in the environment, many PFAS are found in the blood of people and animals all over the world and are present at low levels in a variety of food products and in the environment. PFAS are found in water, air, fish, and soil at locations across the nation and the globe. Scientific studies have shown that exposure to some PFAS in the environment may be linked to harmful health effects in humans and animals." Among the potential health risks of some PFAS compounds for humans are:

- impacts on the immune system (including decreased vaccine responses)
- endocrine disruption
- reproductive impacts, including lowered infant birth weight
- developmental delays in children
- increased risk of hypertension, including in pregnant people (eclampsia)
- alterations to liver enzymes
- increased risk of some cancers, including prostate, kidney, and testicular
- increase in circulatory cholesterol levels
- increased risk of cardiometabolic diseases (via exposure during pregnancy)
- possible increased risk of Covid-19 infection and severity

After years of advocate pressure, EPA in August proposed "to designate two of the most widely used per- and polyfluoroalkyl substances [—PFOA and PFOS—] as hazardous substances under the *Comprehensive Environmental* Response, *Compensation, and Liability Act* (CERCLA), also known as 'Superfund.'" That designation should mean that polluters must be more transparent about their pollution and be held accountable for cleanup of their PFAS contamination. EPA took the step pursuant to its recognition of "significant evidence that PFOA and PFOS may present a substantial danger to human health or welfare

or the environment. PFOA and PFOS can accumulate and persist in the human body for long periods of time and evidence from laboratory animal and human epidemiology studies indicates that exposure to PFOA and/or PFOS may lead to cancer, reproductive, developmental, cardiovascular, liver, and immunological effects."

In addition, in June 2022 EPA issued interim updated drinking water health advisories for two PFAS compounds—perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS)—replacing those issued in 2016. The agency also issued final health advisories on two others that had been considered "replacement" chemicals for manufacturing uses: perfluorobutane sulfonic acid and its potassium salt (PFBS), and hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt (the so-called "GenX chemicals").

In June 2022, EPA set "acceptable" exposure levels for PFOA and PFOS at 0.004 and 0.02 parts per trillion, respectively. These are lower than generally detectable levels (absent new, more-sensitive tests), so EPA now encourages municipalities or other water-supply entities to take action against PFOA and PFOS should any level be detected in a drinking water system. (See EPA's factsheet here.) Guidelines in individual states, if they even exist, are generally much higher than these new EPA parts-per-trillion levels.

PFAS compounds have been found to contaminate water and irrigation sources, and soils themselves—often through the use of fertilizers made from so-called "biosludge" from local waste treatment plants. In addition, these plants may discharge millions of gallons of wastewater into waterways, contaminating them; current waste and water treatment does not generally eliminate PFAS compounds from the treated effluent water. (Some water providers are now piloting PFAS remediation protocols, though they are currently both challenging and quite expensive.) Biosolids and wastewater have long been sources of exposure concerns related to pesticides, industrial chemicals, pharmaceuticals, personal care products, and household chemicals; PFAS contamination is now rising as a specific and concerning addition to that nasty list.

EWG wrote, earlier in 2022, that these forever (and perhaps "everywhere") compounds may be contaminating nearly 20 million acres of agricultural land in the U.S. A significant portion of producers, perhaps 5%, is using biosludge from local treatment plants as fertilizer on their acreage. Use of biosludge was thought by many, a decade ago, to be a sensible use of the waste products from treatment; it was even encouraged by many state agricultural department programs. Fast forward to the current recognition that these products have no business being spread on fields that produce food—or perhaps anywhere that presents the possibility of human, organism, or environmental exposures to potentially toxic PFAS compounds. It is notable that there are currently no federal requirements to test such sludge for the presence of PFAS.

The agricultural sector is increasingly experiencing very serious impacts from these compounds. Senator Collins, in her office's news release on her bill, noted, "PFAS contamination has prevented some Maine farms from selling their products, creating financial hardship for many family farmers. In 2016, a dairy farmer in Arundel discovered that the milk produced on his farm contained some of the highest levels ever reported for a PFAS contaminant. In 2020, a dairy farm in Fairfield found PFAS levels in its milk were 153 times higher than the Maine standard. An organic vegetable farm in Unity uncovered PFAS contamination last year, and the couple who farmed the land have higher PFAS levels in their blood than chemical plant workers who manufactured PFAS for decades. Numerous other Maine farmers have had their livelihoods disrupted due to PFAS contamination."

Beyond Pesticides wrote about two of the instances Senator Collins references. One is the devastation of one organic Maine farm, Songbird Farm in Unity, which learned in 2021 that its well water tested at 400 times the state's recommended threshold for PFAS compounds. The farmers' land, livelihood, and health are at stake, with few supports in place (at the time) to help them through this crisis. Another is an Arundel, Maine dairy farmer who has, for years, been testifying to the state legislature about the ruination of his multigenerational dairy operation by the discovery of PFAS in his water and soils, and in his cows' milk—largely attributable, he says, to the wholesale contamination of the biosludge he had used on his silage crop fields for years.

PFAS compounds have been found to contaminate . . . fertilizers made from so-called "biosludge" [biosolids, often called compost] from local waste treatment plants.

The federal government has been slow to acknowledge and act on the threats of PFAS. With the advent of the Biden administration, that has begun to change. In 2021, EPA Administrator Michael Regan announced the *PFAS Strategic Roadmap*, which purports to lay out a whole-of-agency approach to addressing the multiple PFAS problems. (Read about the *Roadmap* here.) Beyond Pesticides covered PFAS (and other legacy chemicals) and wrote, "For states and localities, who are on the front lines of PFAS contamination, this is welcome news *and* significantly tardy. Absent much protective action on forever chemicals at the federal level . . . states have been stepping up, particularly in the past five years or so, to deal with a problem that permeates many aspects of people's lives."

The bill proposed in Congress (S. 5070) aims to create and fund grant programs that, administered by states, will provide:

- health monitoring for affected farms, farmers, and families
- medical care for farmworkers and families exposed to PFAS, and for

anyone who experiences exposure-related health effects or has a blood level higher than that of the general U.S. population
- relocation assistance for farms found to be PFAS contaminated
- compensation for contaminated land or farm products
- investments in equipment, facilities, and infrastructure to help farmers transition to different cropping approaches, implement remediation strategies, and/or switch to an alternate revenue stream (with a focus on combining solar generation with agricultural uses)
- help with income replacement and mortgage payments
- improved PFAS testing and data management for states
- support for research to quantify the impact of PFAS on commercial farms and agricultural communities

Senator Collins commented on the need for the bill, "USDA needs to step up and provide support to farmers, who at no fault of their own, are at risk of losing their livelihoods. This is not just a problem in Maine—PFAS contamination has been discovered on farms in New Mexico and Michigan [and elsewhere], and this problem will only become more evident as testing becomes more readily available. Thus far, the federal government's response has failed to keep pace with this growing problem."

Senator Shaheen added in her press release, "The more we look for PFAS, the more we understand how widespread these chemicals are, and unfortunately our farming community is no exception. That's why it's imperative that we have a robust federal response for industries and communities that have been adversely impacted. . . . This bipartisan, bicameral proposal is a comprehensive approach to help farmers who've been hard hit by PFAS exposure, and it addresses everything from educational programs for individuals affected to increased water and soil testing and remediation. Our farmers face enough challenges and adversity from uncontrollable shifts in our climate and economy—reacting to an expansive and troubling issue like PFAS contamination shouldn't be another hurdle they have to face alone."

Beyond Pesticides commends these legislators for filing this bill, which would, if passed and enacted, bring significant help to agricultural producers and their communities affected by PFAS. These groups currently are struggling to deal with the devastating discoveries of contamination of their soil, water sources, and/or agricultural products, largely without much governmental support. Beyond Pesticides recommends that the "transition to different cropping approaches" require the transition to organic systems.

These most-recent PFAS discoveries, and state legislative efforts to deal with them, underscore not only the federal failures, but also, the urgency and gravity of realigning federal and state agencies so that precaution becomes the guiding watchword.

For its part, Maine has been more proactive than most states on PFAS; the state legislature, for example, passed a bill in early 2022 to ban the use of pesticides and fertilizers contaminated with PFAS. It has also passed a bill to reduce toxic chemicals in packaging, and another that will ban the sale or distribution of carpets, rugs, or fabric treatments that use PFAS compounds (effective 2023), and in 2030, the use of PFAS in all consumer products in the state.

Meanwhile, according to Maine Public (radio), the Maine Department of Environmental Protection is now testing more than 700 sites in the state considered at high risk for PFAS contamination because they were licensed to receive applications of municipal biosludge. PFAS contamination has been found at more than 40 Maine farms (as a result of biosludge fertilizer applications). Maine Public reports, in addition, that "hundreds more private drinking wells—as well as some school drinking water supplies—have . . . been found to be contaminated. In response, the administration of Gov[ernor] Janet Mills and state lawmakers have earmarked $100 million for PFAS testing, response, remediation and research in recent years."

Responding to the proposed federal legislation, Maine Organic Farmers and Gardeners Association Executive Director Sarah Alexander said, "I think this [proposed federal] legislation is really critical for setting a safety net for farmers . . . because we know that the problem of PFAS contamination on agricultural lands is not specific to Maine. We just happen to be the first state that's looking for it." She also noted that the federal bill mirrors some initiatives underway as the Maine response to increasing numbers of PFAS hotspots linked to contaminated sludge.

The "meta" issue, about which Beyond Pesticides wrote earlier this year, continues to be relevant: "These most-recent PFAS discoveries, and state legislative efforts to deal with them, underscore not only the [historical] federal failures, but also, the urgency and gravity of realigning federal and state agencies so that precaution becomes the guiding watchword. Legacy/forever chemical contamination is a dramatic demonstration of how the historical, non-precautionary ethic in the U.S. can cause egregious harm—even years and decades hence. Government regulation should, at the very least, stop making the problem worse through continued permitting of the use of PFAS compounds and toxic pesticides."

What to do: Tell Congress to address contamination with PFAS and other legacy chemicals by cosponsoring the *Relief for Farmers Hit with PFAS Act*, H.R.9186 U.S. House of Representatives and S.5070 in the U.S. Senate.

SOURCES: Collins, Susan. U.S. House of Representatives. "Maine Delegation Introduces Bill to Support Farmers Affected by PFAS." Press Release. October 21, 2022

KEEPING ORGANIC STRONG | SEPTEMBER 12, 2022

Organic Integrity Before the Public, Comments Due by September 29

Comments are due by 11:59 pm EDT September 29. The National Organic Standards Board (NOSB) is receiving written comments from the public through September. This precedes the upcoming public comment webinar on October 18 and 20 and deliberative hearing October 25–27—concerning how organic food is produced. Sign up to speak at the webinar by September 29. Written comments must be submitted through Regulations.gov. by 11:59 pm EDT September 29. Links to the virtual comment webinars and the public meeting will be posted on this webpage in early October.

The NOSB is responsible for guiding the U.S. Department of Agriculture (USDA) in its administration of the *Organic Foods Production Act* (OFPA), including the materials allowed to be used in organic production and handling. The role of the NOSB is especially important as we depend on organic production to protect our ecosystem, mitigate climate change, and enhance public health.

The NOSB plays an important role in bringing the views of organic producers and consumers to bear on USDA, which is not always in sync with organic principles. There are many important issues on the NOSB agenda this Spring. For a complete discussion, see Keeping Organic Strong and the Fall 2022 issues page. Here are some high priority issues for Beyond Pesticides:

- **Organic Agriculture is Climate-Smart Agriculture.** The NOSB draft letter to Secretary of Agriculture Vilsack is an excellent primer on how organic agriculture responds to the climate emergency. However, the letter needs to stress the need for USDA to promote conversion to organic farming. More important to addressing the climate crisis than the questions posed by NOP are questions concerning how USDA programs can assist organic producers and those seeking to convert to organic. The draft letter addresses these as well.

  It also points out the resiliency of organic agriculture: "Organic is the solution to mitigating climate change *and* responding to it. "In view of the climate benefits of organic and the incentives inherent in organic marketing, the real question is whether USDA will abandon its promotion of chemical-intensive agriculture supported by the biotech/chemical industry in favor of whole-hearted support for organic agriculture—because despite the astronomical growth in organic consumption in the U.S., conversion

The National Organic Standards Board plays an important role in bringing the views of organic producers and consumers to bear on USDA, which is not always in sync with organic principles. There are many important issues on the NOSB agenda this Spring.

to organic agriculture lags behind demand. USDA could and should make adoption of organic/climate-smart practices a prerequisite for receiving the benefits of its programs.

- **Biodegradable Biobased (Bioplastic) Mulch Film** (BBMF) is under consideration for sunset this year. This is part of a larger issue of the use of plastic in organic production and handling. Awareness is growing about the impacts of plastic—and the microplastic particles to which it degrades—on human health and the environment. BBMF should not be relisted. Moreover, the NOSB should initiate action to eliminate all uses of plastic in organic production and handling—including packaging.
- **The NOSB should use the sunset process** to eliminate non-organic ingredients in processed organic foods. Materials listed in §205.606 in the organic regulations are non-organic agricultural ingredients that are allowed to be used as ingredients as part of the 5% of organic processed foods that is not required to be organic. Materials should not remain on §205.606 if they can be supplied organically, and anything that can be grown can be grown organically. The Handling Subcommittee needs to ask the question of potential suppliers, "Could you supply the need if the organic form is required?" Two materials on §205.606 are up for sunset this year—pectin and casings. Both are made from agricultural products that can be supplied organically and thus should be sunsetted.

What to do: Need help in submitting comments? Regulations.gov requires more than a single click, but it is not difficult. Please feel free to cut-and-paste the three comments above into Regulations.gov and add or adjust the text to personalize it. See this instructional video. (Regulations.gov has changed its look since this video was made.) Thank you for keeping organic strong!

SOURCE: Beyond Pesticides. "Keeping Organic Strong: Changes in organic regulations and farming practice." National Organic Standards Fall 2022 Meeting. https://www.beyondpesticides.org/programs/organic-agriculture/keeping-organic-strong-fall-2022

PREEMPTION OF LOCAL AUTHORITY DECEMBER 19, 2022

In New Congress, Republican-Led Legislation Would Prevent Local Governments from Protecting Health and Safety

As the new 118th Congress convenes on January 3, 2023, one of the key issues on the agenda led by Republicans in the U.S. House of Representatives is preemption of local authority to restrict pesticide use—undercutting the local democratic process to protect public health and safety. In the 117th Congress, H.R. 7266 was introduced to prohibit local governments from adopting pesticide laws that are more protective than federal and state rules. If H.R. 7266 were to pass or be incorporated into the 2023 Farm Bill, as the pesticide industry and proponents of the legislation plan to do, this bill would overturn decades of precedent as well as prevent local governments from protecting their residents from hazardous chemicals in their environment.

This is a direct assault on nearly 200 communities across the country that have passed their own policies to restrict the use of toxic pesticides. Communities must maintain the right to restrict pesticides linked to cancer, water contamination, and the decline of pollinators to protect their resident's health and unique local ecosystems.

The bill hinges on the concept of preemption: a legal theory that allows one jurisdiction to limit the authority of a jurisdiction within it to regulate a specific issue. In 1991, the Supreme Court specifically upheld the authority of local governments to restrict pesticides throughout their jurisdictions under federal pesticide law in *Wisconsin Public Intervenor v. Mortier*. The Court ruled that federal pesticide law does not prohibit or preempt local jurisdictions from restricting the use of pesticides more stringently than the federal government throughout their jurisdiction. According to Mortier, however, states may retain authority to take away local control.

Communities must maintain the right to restrict pesticides linked to cancer, water-contamination, and the decline of pollinators to protect their resident's health and unique local ecosystems.

In response to the Supreme Court decision, the pesticide lobby immediately formed a coalition, called the Coalition for Sensible Pesticide Policy, and developed boilerplate legislative language that restricts local municipalities from passing ordinances on the use of pesticides on private property. The Coalition's lobbyists descended on states across the country, seeking, and passing, in most cases, preemption legislation that was often identical to the Coalition's wording. Since the passage of those state laws, there have been numerous efforts to prohibit localities from developing policies reflecting the unique needs and values of the people living there.

If the pesticide industry is successful, the impacts for public health and ecological stability would be devastating. Only states and the federal government would be able to regulate pesticide use. With most state agencies allowing all uses on labels approved by the U.S. Environmental Protection Agency (EPA), local jurisdictions would be forced to follow the rulemaking of an agency that has been documented to be captured by industry interests.

Preemption would quash a growing national grassroots movement encouraging alternatives to toxic pesticides where people live, work, and play. Federal preemption would prevent local governments from instituting pesticide regulations that are stricter than federal regulations, taking away communities' basic right to secure their own safety and interrupting a burgeoning movement of local pesticide restrictions. H.R. 7266 and its successor legislation in the new Congress would also prevent states from giving localities the right to regulate pesticides.

Many pesticides targeted by local city residents, including neonicotinoids, glyphosate, and atrazine, have been banned or restricted in other countries due to health or environmental concerns. However, in the U.S., EPA has not taken similar action on these pesticides. Given federal inaction and the previous administration's failure to follow sound science, it is imperative that local governments retain the ability to tailor laws so localities can respond to federal actions that permit the use of toxic chemicals that residents do not want in their community.

With most state agencies allowing all uses on labels approved by the EPA, local jurisdictions would be forced to follow the rulemaking of an agency that has been documented to be captured by industry interests.

Having failed to curtail prohibitions against local restrictions into the 2018 Farm Bill after massive pushback from health advocates, local officials, and Congressional allies, the chemical industry is renewing its attack. The industry continues to flex its muscle in Congress through attempts to add preemption language in the 2023 Farm Bill as a growing number of communities are deciding to act.

What to do: Take action today and tell your U.S. Representative and Senators to support communities by opposing H.R. 7266 (and successor legislation in the new Congress) and the inclusion of this anti-democratic language in the 2023 Farm Bill.

Your support is needed to defend local governments' rights to pass regulations that protect their communities against toxic pesticides. If you are interested in taking action this January by contacting your local officials and encouraging them to send a letter to the new Congress opposing preemption, please check the box under "Additional Information" on the Action form and we will reach out to you with more information at the beginning of 2023.

SOURCE: Davis, Rodney. U.S. House of Representatives. "Davis Introduces Legislation to Prevent Liberal Local Governments from Banning or Restricting Pesticide Use." Press Release. March 31, 2022

ACTION

The very bright spot, exemplifying what is possible to confront the health, biodiversity, and climate crises, is found in the action that is taken in communities and states to eliminate toxic pesticide use. Much of this work is still incident-driven and focused on specific chemical threats, like the neonicotinoid insecticides that kill bees or PFAS—per- and poly-fluoroalkyl substances—that have contaminated farmland, the food chain, and ecosystems. Importantly, communities are phasing out pesticides in their parks and on playing fields and embracing organic land management as a holistic strategy to fight the threats that pesticides pose to health, biodiversity, and climate. Even the U.S. Department of Agriculture is investing more in organic, although it is insufficient relative to what is required. Clearly, the hands-on data finds that organic, climate-friendly agricultural systems work and, in fact, are more profitable for farmers than chemical-intensive agriculture.

PARKS FOR A SUSTAINABLE FUTURE | APRIL 1, 2022

On Earth Day, Coalition Calls on NYC Parks Department to Set Up Demonstration Sites

A year after the passage of a landmark New York City law banning the use of toxic pesticides in city parks, playing fields, playgrounds, and open space, the Eco-Friendly Parks for All coalition is calling on the Parks Department to establish organic demonstration sites across the city. The coalition is underwriting the cost of the demonstration sites, which are intended to show how advances in soil technology and modified horticultural techniques can produce lush and resilient landscapes without the use of chemical pesticides.

This call for action comes seven months before a law, passed unanimously by the City Council on Earth Day last year, requires that all public parks in the City are managed only with organic compatible materials defined by federal law. The coalition is urging immediate action so that demonstration sites can be up and running before the fall when the law goes into effect. The professional consulting services required to manage the sites are funded through a donation from Stonyfield Organic, the national yogurt company which has been a pioneer and leader in organic practices since 1983.

Eco-Friendly Parks for All is a coalition of local organizations that seeks to protect all those who use the parks (especially children, pets, older people, those with underlying health conditions and disproportionately at risk, and workers) and ensure the sustainability of New York City's ecosystem. Members include Beyond Pesticides, Grassroots Environmental Education, The Black Institute, Children's Environmental Health Center at the Icahn School of Medicine at Mount Sinai, and Voters for Animal Rights.

"To further the impact of our program, we are thrilled to support Bill #1524 in New York City, by donating $60,000 toward transitioning NYC parks to organic maintenance," said Gary Hirshberg, Stonyfield cofounder and Chief Organic Optimist. "Our StonyFIELDS PlayFree initiative, launched in 2018, strives to help keep families free from harmful pesticides in parks and playing fields across the country."

"Children are uniquely vulnerable to the harmful effects of chemical exposures. All NYC children deserve access to healthy parks free of synthetic pesticides," says Dr. Sarah Evans, Assistant Professor at Icahn School of Medicine at Mount Sinai.

"This law is a long time coming after the many lives spent in engaging with toxic air and land in parks, most of whom are disproportionately black and brown people," said Adeel Ahmed, Community Organizer of The Black Institute, a Brooklyn-based nonprofit. "As grateful as we are for this law after the energy spent on organizing for it, we are calling on the parks department now to implement this law with urgency through moving towards organic maintenance of the parks while emphasizing racial equity as the center of this law's implementation."

"The NYC parks law banning toxic pesticides ensures a legacy of safe public places for people to gather, play, and bring their pets, while at the same time contributing to the safety of NYC air and waterways," said Jay Feldman, Executive Director of Beyond Pesticides, a nonprofit organization based in Washington, DC.

"This law to ban pesticides also addresses the city's stated goals of reducing fossil fuel-based products in an effort to become more sustainable. New York City is leading the way for municipalities all over the world who are seeking to reduce their carbon footprint," says Patti Wood, Executive Director of NY nonprofit Grassroots Environmental Education. "Petroleum and gas are feedstock for pesticides and fertilizers."

"This law fulfills a dream of my former kindergarten students who, while learning about how foods in the school cafeteria are grown, learned about the dangers of pesticides," said Paula Rogovin, NYC public school teacher, now retired, who launched the original effort with her students, parents, and then-NYC Councilmember Ben Kallos. "Then, they learned about pesticide use in the parks. The bill was introduced into the City Council on their behalf. It took a team of individuals and organizations working together to ensure this important legislation was passed. Pesticide-free parks will benefit millions of New Yorkers, visitors, and their pets."

What to do: Talk to elected officials and the parks department in your town/city/county by using the material provided by Parks for a Sustainable Future. Contact info@beyondpesticides.org for more information and to discuss what help Beyond Pesticides can offer.

SOURCE: Eco-Friendly Parks for All, "On Earth Day, Coalition Calls on NYC Parks Department to Set Up Demonstration Sites." April 20, 2023.

ORGANIC FOOD IN SCHOOLS | MARCH 8, 2022

Covid Leads to Transformational Moment for Launching of School-Based Feeding Programs with Organic Food

A silver lining has emerged from the past two devastating Covid years, according to Civil Eats. A large California school district has used pandemic changes—in the regulatory schema of the federal and state governments, in supply chain function, and in available funding—to catalyze the transition to organic food in school-based feeding programs. For the past decade or so, U.S. school districts have, here and there, been moving gradually in this direction. The West Contra Costa Unified School District (WWCUSD) is robustly making the transition to organic, in no small part through its collaboration with Conscious Kitchen, a local nonprofit that seeks to "break the cycle of conventional, packaged, overly processed food, [and] transitioning to meals based on five foundational

attributes: fresh, local, organic, seasonal and nutritious." Beyond Pesticides has long pointed to the importance of shifting school-based meals to organic for multiple reasons, but centrally, because the pesticides with which conventional food is generally contaminated have outsized health and developmental impacts on children.

The WWCUSD, which is northeast of San Francisco, serves 30,000 students —75% of whom come from low-income households. The district's food service director, Barbara Jellison, and other food service leaders in the state have seized the moment of Covid disruption and the "pause" in standard operating procedures to shift toward what she sees as better food for her students. Food service in most schools in the U.S. was turned upside down with the twists and turns of navigating Covid protocols amid remote learning, hybrid learning, and in-person learning, as well as constantly changing attendance patterns, masking requirements, and staffing shortages, among other factors.

In addition, as Civil Eats reports, "numerous disruptions loosened regulations that [have made] it difficult for any supplier other than the largest conventional food companies to get their food into cafeterias. The federal and state government both sent extra funds to California schools to ensure children would not go hungry. And global supply-chain snags gave smaller, local farms a leg up; many of those farms in Northern California are organic."

As Covid arrived, WWCUSD's food service teams first made hot meals available for pick-up by low-income families. That then shifted, because of a U.S. Department of Agriculture (USDA) waiver, to distribution of boxes of raw ingredients—with enough ingredients for a week's worth of three daily meals plus snacks. In the fall of 2020, when the district was in remote mode, Ms. Jellison called Judi Shils of Conscious Kitchen to ask for help. She wanted to shift at least some of the contents of the food boxes to organic.

Ms. Shils contacted some of those local Northern California organic farms and food vendors, including Full Belly Farm, Earl's Organic, and Lundberg Family Farms, and the organic transition was soon under way. In short order, Ms. Jellison's team was distributing more than 20,000 boxes each week, and could provide items such as ground beef, beans, grains, fruits, and vegetables. By March 2021, the food boxes were 100% organic, and the district had invested $17 million in the purchase of 10.7 million pounds of organic food for students' low-income families. The Conscious Kitchen website provides an excellent array of infographics and other information on the program here.

Food service in many, if not most, schools in the U.S. was turned upside down with the twists and turns of navigating Covid protocols amid remote learning, hybrid learning, and in-person learning, as well as constantly changing attendance patterns, masking requirements, and staffing shortages, among other factors.

Civil Eats notes Ms. Shils's comment: "It was incredible to see what can happen during a pandemic, when all [the farms] needed was business and when all families needed was food. And then I thought, 'Okay, we're going to go back to school someday. How do we keep the integrity of the supply chain in a district that has never had organic food?'" Previously, such small organic producers would have had little chance of participating in the school lunch bid process because USDA regulations made it difficult for suppliers other than large, conventional food processors/companies to get a foot in the cafeteria door. Now, all these small, organic producers had become vendors in the system. This has had knock-on effects on local organic growers and producers, many of whom had lost wholesale restaurant and other accounts because of lowered demand during the pandemic.

Another salutary outcome of the push for organics in schools was their introduction into federal food purchasing programs, and especially into one called "DoD Fresh." With the full and unwieldy moniker, "U.S. Department of Agriculture (USDA) Department of Defense (DoD) Fresh Fruit and Vegetable Program," DoD Fresh had historically had no organics available in the subsidized, bulk food program for schools; policy advocacy by Friends of the Earth and other organizations changed that.

Deputy director of food and agriculture at Friends of the Earth (FOE), Kari Hamerschlag, commented, "Until recently there was no organic available [in the program]. So we worked with the suppliers in both Northern California and Southern California . . . and we got them to add a whole slew of different organic products." Civil Eats reports FOE's estimate that, in a three-month period in late 2021, that change resulted in 80,000 pounds of organic food (worth $100,000) showing up in California school-based meals.

So, though further progress will not be free of challenges, the two women believe they have sufficient sourcing and coordination infrastructure and protocols in place so that what they have accomplished can be replicated in other districts. Ms. Shils notes that already, they can see ripple effects: "Those companies that we were connected to and supported us and we supported them through the majority of the pandemic . . . they're learning how to work with schools and how to reformulate some of their items to meet our requirements, and hopefully will be able to support other school districts in time."

One example of that ripple was the work Ms. Shils and Ms. Jellison did with Mindful Meats (purveyor of organic, grass-fed beef from retired dairy cows) to develop a pre-cooked burger patty that would work once students returned to in-person school. That burger was then added to the repertoire of food service in the San Francisco Unified school district, which lacks "from

scratch" cooking facilities. Then came sourcing of organic burger buns from Alvarado Bakery. Item by item, districts are ratcheting up the organic content of school meals. Ms. Jellison "is checking off each organic box," according to Civil Eats; she adds, "Since we've gone back into the schools, we've made tremendous gains that we weren't able to do during that pilot year."

The women believe that the best path for districts in this pursuit is to partner with nonprofits working in the sector. For WWCUSD, the partnership with Conscious Kitchen was transformative, allowing an already stressed and challenged food service system to make significant headway. Ms. Shils commented, "Most food service directors are up to their eyeballs, especially now, in regulations and they don't have time to think. Every community I believe could have a partner. There are lots of nonprofits out there."

A focus on getting organics into school feeding programs has been afoot for years, and has proponents in multiple places, including in Congress and in state houses. A 2020 study out of the University of California Berkeley found that roughly 30% of school districts in the state are purchasing some organic food items. Farm-to-School nonprofits and programs have sprouted up in many states, and USDA's Food and Nutrition Service conducts a grant program for such initiatives. The California Department of Food and Agriculture recently published its report on the farm-to-school movement, Planting the Seed, which provides guidance on how to expand, support, and strengthen such programs in the state.

The report emphasizes the potential for such programs to address multiple critical issues, noting that farm-to-school programs "serve as a powerful tool to build demand and expand markets for producers that use . . . verified climate smart agriculture production systems, including certified organic and transitioning to organic certification systems." Civil Eats notes that one of the report's working groups recommended that building relationships between organic producers and schools should be a top priority.

Multiple school districts across the nation—in Boston, New York City, Buffalo, Washington, DC, Los Angeles, Denver, Austin, Chicago, Cincinnati, Pittsburgh, and a few others—are working with the nonprofit Center for Good Food Purchasing to move the needle on organic purchasing. The center "uses the power of procurement to create a transparent and equitable food system that prioritizes the health and well-being of people, animals, and the environment. We do this through the nationally networked adoption and implementation of the Good Food Purchasing Program by major institutions."

The mission is shared and is being advanced by many advocacy organizations, as well—including Beyond Pesticides. Ms. Hamerschlag of FOE, who has worked for half a decade on getting more organic food into schools, comments, "The benefits of organic are significant in terms of climate, soil health, and reducing toxic pesticide exposure."

Beyond Pesticides has written often about the many upsides of organic food production and consumption, which advance multiple health and environmental goals: reduced health harms to children and farmworkers from synthetic pesticide and fertilizer use, improved health outcomes for children and adults (including lowered obesity rates), reduction of environmental/ecosystem and biodiversity degradation, and greater equity for environmental justice communities and populations.

Indeed, the whole Conscious Kitchen model is based on getting "all-organic, scratch-cooked, plant-forward meals to districts that serve a large proportion of low-income students." Ms. Shils notes that because organic food often costs more than conventional food (i.e., food raised with synthetic pesticides and fertilizers), it can be economically infeasible for some students' families to purchase organic. Thus, school lunch is an opportunity to provide the most healthful fare for students.

She emphasizes that this helps rebalance the equity scales and shifts the local food system in a more sustainable direction. "When you have hundreds of thousands of children needing to be fed, it creates a lot of leverage, and food prices go down, our land is healthy, the agricultural practices [are better for the workers], and we mitigate climate change," Ms. Shils commented. Conscious Kitchen generated a case study of the WWCUSD initiative—*Organic, Plant-Forward, Scratch-Cooked School Meals: A California Case Study*.

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Lena Brook of the Natural Resources Defense Council (NRDC), which has advocated with California state government agencies to integrate more organic-specific incentives into their grants programs, notes: "We can't afford to be solving one problem at a time anymore. We have a climate crisis, various public health crises, biodiversity [loss], drought, wildfires, etc. Where do we put our investments in order to tackle more than one at a time? For me, organic sits at the center of this."

What to do: Beyond Pesticides concurs. To learn more about the harms of pesticides in children's diets, and the benefits of organic foods, see the Fact-sheet, *Children Need Organic Food*, and these webpages: Kids Who Eat Organic Food Score Higher on Cognitive Tests, Health Benefits of Organic Agriculture, Study Shows Organic Food Diet Reduces Residues of Glyphosate in Body, and Hazards of Pesticides for Children's Health, among others.

SOURCE: Held, Lisa. "Pandemic Disruptions Created an Opportunity for Organic School Meals in California." Civil Eats. February 28, 2022

EUROPEAN UNION BANS PESTICIDES IN PARKS | JULY 1, 2022

EU Bans Pesticides in Parks, Playgrounds, and Playing Fields; Fails to Set Organic Transition Goals in Ag

The European Commission (EC) introduced on June 22 new rules that ban all pesticides in "public parks or gardens, playgrounds, recreation or sports grounds, public paths, as well as ecologically sensitive areas." In agriculture, the policy adopts strategies for achieving the pesticide use- and risk-reduction goals of its Farm to Fork initiative. The EC—the European Union's (EU's) politically independent executive arm—proffered new rules that are binding on all EU Member States. Those states must, in turn, adopt their own binding targets to help meet the overall EU targets—a 50% reduction in use and risk of chemical pesticides, and a 50% reduction in use of more-hazardous pesticides, by 2030. Beyond Pesticides has covered the shortcomings of the EU's previous approach, the Common Agricultural Policy (CAP), the Farm to Fork (F2F) strategy and its 2021 disparagement by U.S. Department of Agriculture (USDA) Secretary Tom Vilsack, and his apparent turnaround in the large and recently announced USDA investment in the U.S. transition to organic agriculture (albeit without metrics or acreage goals), a transition F2F seeks to advance for the EU.

Regarding the ban of pesticides in parks, the policy says: "Use of plant protection products may have particularly negative impacts in certain areas that are frequently used by the general public or by vulnerable groups, communities in which people live and work and ecologically sensitive areas, such as Natura 2000 sites protected in accordance with Directive 2009/147/EC of the European Parliament and of the Council and Council Directive 92/43/EEC34. If plant protection products are used in areas used by the public, the possibility of exposure of humans to such plant protection products is high. To protect human health and the environment, the use of plant protection products in sensitive areas and within 3 metres of such areas, should therefore be prohibited. Derogations from the prohibition should only be allowed under certain conditions and on a case by-case basis."

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[According to the policy: "sensitive area" means any of the following: (a) an area used by the general public,

such as a public park or garden, recreation or sports grounds, or a public path; (b) an area used predominantly by a vulnerable group as defined in Article 3(14) of Regulation (EC) No 1107/ 2009. . .] The policy goes into effect on 20th day following its publication in the Official Journal of the European Union.

The EC says, "We need to redesign our food systems, which today account for nearly one-third of global GHG emissions, consume large amounts of natural resources, result in biodiversity loss and negative health impacts . . . and do not allow fair economic returns and livelihoods for all actors, in particular for primary producers." F2F is one major component of the European Green Deal—a plan to make Europe the first climate-neutral continent and "transform the EU into a modern, resource-efficient and competitive economy, ensuring (1) no net emissions of greenhouse gases by 2050, (2) economic growth decoupled from resource use, [and] (3) no person and no place left behind."

F2F aims to accelerate the transition to what it calls a "sustainable food system"—one that would:

- ensure food security, nutrition, and public health, ensuring that everyone can access sufficient safe, nutritious food
- have a neutral or positive environmental impact
- help mitigate climate change and adapt to its impacts
- reverse biodiversity loss
- preserve affordability of food while generating fairer economic returns, fostering competitiveness of the EU supply sector, and promoting fair trade

The new rules proposed by the EC introduce several provisions in pursuit of such a sustainable food system, including:

- legally binding pesticide-use-reduction targets
- strict enforcement of "environmentally friendly" pest control, i.e., ensuring that all farmers practice Integrated Pest Management (IPM), in which all alternative methods of pest control are considered first, before chemical pesticides can be used as a last resort; Beyond Pesticides notes that this is not the same as organic production, wherein (in the U.S.) nearly no chemical pesticides are permitted
- a ban on the use of *all* pesticides in sensitive areas (such as ecologically vulnerable areas, public parks and gardens, recreational/sports fields, playgrounds, and public paths)
- EU financial support for farmers ("for 5 years, Member States can use the CAP to cover the costs of the new requirements for farmers")

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The EC rationale for these new rules rests on its recent evaluation of the previous iteration of the *Sustainable Use of Pesticides Directive*, and the commission's subsequent conclusion that existing rules have been both far too anemic and implemented unevenly. The EC evaluation, as well as conclusions from the European Court of Auditors (the EU's independent financial oversight body) and the European Parliament, demonstrated insufficient progress on the reduction of the risks and impacts of pesticide use on human health and the environment. (It should be noted that the F2F strategy strives for what it defines as "sustainable" use of pesticides, rather than "zero" use.)

The EC announcement added that those bodies identified "insufficient progress in promoting the use of Integrated Pest Management and alternative approaches or techniques, such as nonchemical alternatives to pesticides, in part, because already now chemical pesticides can harm human health and continue to contribute to biodiversity decline in agricultural areas, contaminate the air, the water and the wider environment."

The EC cited several catalytic factors driving these new strategies: (1) major health risks from chemical pesticide exposure; (2) detection of pesticides above their effect threshold at 13–30% of all surface water monitoring sites in lakes and rivers across the EU; and (3) the pollinator and insect decimation, particularly as Europe already faces a pollination deficit. It also noted, "In case of inaction, the outlook for all environmental indicators is bleak with further declines in biodiversity."

The announcement included this: "Our food production systems need to reduce their negative impact on climate change and biodiversity loss. The costs of inaction hugely outweigh the costs related to the transition towards sustainable food systems. The new rules will ensure that farmers and consumers can benefit from sustainable food systems and that our long-term food security is safeguarded."

The EC offered information on how the outcomes of the new rules, once active (in a couple of years), will be monitored and measured. Data on the use and risks of pesticides will be ascertained annually through data on the sale of pesticides (or PPPs, Plant Protection Products), as reported to the EC by EU Member States. The baseline from which to calculate reductions will be the average pesticide sales in 2015, 2016, and 2017. All PPPs on the market will be assigned to one of four groups, each of which is assigned a "weighted" significance in terms of the compounds' inherent risks; higher weightings reflect higher risk. The system encourages the use of PPPs containing low-risk active substances (many of which are nonchemical), and to discourage the use of PPPs containing more-hazardous substances.

The focus on high-hazard compounds is well placed. Recent research, published in *Environment International*, concludes: all of the current 230 active EU-approved, synthetic, open-field-use herbicides, fungicides, and insecticides are hazardous to humans and/or ecosystems; none of those 230 has a completed hazard profile; and 124 of them are "top hazard" compounds.

The researchers investigated the potential ability of seven different pesticide-use reduction scenarios to achieve the 50% reduction goals and concluded that the 50% use and risk reduction target will be achieved only if the number ("pool") of pesticide compounds available on the EU market is significantly reduced, or their uses strongly restricted. The study coauthors asserted that "strong restrictions are needed to match the Farm to Fork pesticide reduction goals."

Environment and public health advocates across the EU are largely in support of F2F. Back in March, when pushback emerged in some other quarters (related to food supply chain issues in light of the Russian war on Ukraine), entities such as Friends of the Earth, Greenpeace, Compassion in World Farming, Climate Justice, and the Pesticide Action Network wrote a letter to the President of the European Commission, Ursula von der Leyen, and other EU officials, saying: "We ask you to address this immediate crisis without undermining the environmental and social progress to which you committed in the European Green Deal."

Pushback came from producer associations, but also, from government officials. The NGO's concern, as reported by *Agri-Pulse*, arose specifically in response to a comment by European Agriculture Commissioner Janusz Wojciechowski, who said, "If food security is in danger, then we need to have another look at the objectives (of Farm to Fork) and possibly correct them." The trade association Copa-Cocega chimed in with a comment asserting that European farmers need to concentrate on producing more corn, wheat, sunflower, and other crops to make up for the gap caused by Ukraine's current inability to export crops.

In early June, Czech Director General for European Affairs Štěpán Černý told *EURACTIV*, "Let's maybe forget for a while on [the] Farm to Fork strategy [...] for a couple of months, and let's mobilize the foodstuff production as much as we can." He added, wrongly, that "The ambition of Farm to Fork . . . is to reduce the amount of food we are producing. And I don't think that's the wise thing to do only this right now when you're being threatened by hunger."

These kinds of comments trot out tired and short-sighted (and arguably, incorrect) arguments that serve profit and/or political ends. Food supply issues during the Ukraine crisis are real and important; yet, they can be dealt with as noted by the United States Institute of Peace and CGIAR (the Consultative Group on International Agricultural Research), without sacrificing the critical long-term strategies of F2F. The agrochemical industry, producers who have become dependent on chemical-intensive production practices, politicians and officials who may fear the power of industry and/or trade groups, and—indirectly—consumers who are accustomed to unreasonably cheap food, may resist the "strictures" of F2F.

Conventional chemical agriculture damages everything that humans care about—health, natural resources and ecosystems, pollinators, economic well-being, and climate chief among them.

But such attitudes fail to see the long-term forest for the cheap and immediate trees: conventional chemical agriculture damages everything that humans care about—health, natural resources and ecosystems, pollinators, economic well-being, and climate chief among them. Organic regenerative agriculture obviates the needs for these chemical inputs and would slash the damage they cause across the globe. F2F rarely uses the term "organic" in its frameworks and rules; nevertheless, they approximates many of the tenets of what the National Organic Standards set out here in the U.S. Further, F2F includes actions aimed to increase organic farming in the EU—to 25% of the EU agricultural land use by 2030.

On this side of the pond, USDA recently announced significantly greater funding for the transition of U.S. agricultural acres to organic production. The agency's early June press release echoed some of F2F's goal language; USDA asserted that this and other newly directed funding aim "to transform the food system to benefit consumers, producers and rural communities by providing more options, increasing access, and creating new, more, and better markets for small and mid-size producers." As Beyond Pesticides wrote then, "It will be critical that this [USDA framework] result in concrete goals that set out specific metrics and timelines—particularly around the magnitude of acres shifted to organic production and the pace of the phaseout of non-organic substances and protocols."

What to do: Whether the enactment of F2F strategies "on and in the ground" ends up comporting with top-level goals of F2F—to transition the agricultural and food sector to one that is "fair, healthy, and environmentally friendly"—is TBD (to be determined). What *is* clear is that the U.S. would do well to create a paradigm-shifting framework, analogous to what the European Green Deal and F2F have set out, for its domestic agricultural sector. USDA's National Organic Program is a robust toolkit already in place; what is required next is legislative and executive action to bring conventional producers into a "big organic tent" that would benefit everyone (save for the pesticide industry) and all of Nature.

SOURCE: European Commission. "Farm to Fork: New rules to reduce the risk and use of pesticides in the EU." Press release, June 22, 2022

LOCAL ORDINANCE BANS PESTICIDES ON PUBLIC LAND | JULY 6, 2022

Norwalk, Connecticut Passes Ordinance Embracing Organic Land Management

Norwalk, Connecticut last week passed an ambitious ordinance banning toxic pesticides and implementing pesticide-free management on all public spaces throughout the city. The move, championed by Common Council member Lisa Shanahan with strong support from other city leaders, as well as public health and conservation organizations, follows nearby Stamford, CT's organic community ordinance passed last September.

"It's high time that we connected people and conscientious lawmakers—linking municipal pesticide bans to the interests of animal advocates, gardeners and conservationists, so that the hazards and risks of using pesticides both informs residents and changes public policies and practices," said Priscilla Feral, president of the Connecticut-based animal advocacy organization Friends of Animal and founder of Pesticide Free Rowayton, organizations which both worked to gather public support for the ordinance.

Prior to the passage of the ordinance, Norwalk land managers were embracing the need to move toward safer approaches to land care and responded to public requests to move in this direction. Pesticide Free Rowayton secured a pesticide-free lawn care program on six public parks, and city staff began phasing out glyphosate use. "Three years now we stopped using Roundup on our property," Superintendent of Parks and Public Property (Recreation and Parks) Ken Hughes told the CT-based news site The Hour. "We never mass treated for weeds or insects."

The ordinance prohibits all pesticides on all Norwalk city property unless use is addressing poison ivy or specified in a Land Management Plan required to be developed by the director of recreation and parks and the city's chief of operations. The land management plan must embrace an organic systems approach to land care, including regular soil testing, the use of only organic fertilizers, careful plant selection, physical and biological controls, consideration of pest biology, and preventive practices that eliminate pest-conducive conditions.

If a situation arises where a city department wants to use a pesticide not specified in the land management plan, the ordinance establishes an interdepartmental pest management team to evaluate exemption requests. Allowances are approved only if there is an imminent threat to health, environment, or public safety, reasonable attempts have been made to address the problem without pesticide use, the pesticide will not impact water quality, and there is evidence the product in question has been proven effective against the pest or weed condition present. If an exemption is granted, the application must include a pest management plan to prevent reoccurrence of the condition using organic land management practices.

Local public golf courses are exempt from pesticide restrictions if they commit to following the Environmental Principles for Golf Courses in the United States. Both public golf courses and city land managers must deliver monthly reports to the Norwalk Common Council regarding pesticide use during the preceding month.

Norwalk's ordinance does not allow exemptions for invasive species and does not differentiate between organic or non-organic pesticides, referring all exemption requests to an interdepartmental pest management team. The team is comprised of city staff and does not include any members of the public. However, through the monthly reports transmitted to the Common Council, both lawmakers and the public can maintain a close watch of pesticide use to ensure that the spirit and intent of the ordinance is fulfilled, and exemptions do not result in the regular use of toxic pesticides.

Along with nearby Stamford, Norwalk's ordinance is critical to safeguarding Connecticut's unique coastal environment and protecting water quality throughout the region. "It's in the best interest of the city and its residents to protect the ecological integrity of the Long Island Sound, Norwalk's River and streams, and improve and protect water quality throughout our region," Council member Lisa Shanahan told The Hour. "These lethal chemicals blindly kill and make no distinction between pests and beneficial insects and healthy organisms."

These sentiments were echoed by others on the Common Council, including member David Heuvelman, who called the ordinance "a first big step for the city… I personally think this is one of the most important things that we as a community can do, especially a community geographically located where we are. The water is important, we need to preserve it, we need to make sure that we are shepherding our water supplies," he said.

To discuss the importance of passing a strong city ordinance around pesticide use, Beyond Pesticides Community Resource and Policy Director Drew Toher joined with Sarah Evans, PhD, of the Ichan School of Medicine at Mt Sinai, and Richard Harris, of the CT-based conservation group Harbor Watch in a series of presentations to city leaders. According to local Norwalk news site, Nancy on Norwalk, Common Council member Nora Niedzielski-Eichner indicated the "quite comprehensive" presentations "changed my views about how our family does pest control."

While many advocates wanted the Council to go further and extend the pesticide ban to private property, the Common Council is prohibited from doing so due to anti-democratic provisions in Connecticut state law known as pesticide preemption. However, as Norwalk is showing, public land care practices set an important example for city residents. The passage of local policies on public lands shows a strong desire for communities to reclaim the authority to regulate toxic chemicals wherever they may cause unnecessary harm.

What to do: Norwalk's strong pesticide ordinance brings it in league with the nearly 200 other local policies recorded on Beyond Pesticides' Map of U.S. Pesticide Reform Policies. If you are interested in joining communities like Norwalk and organizing your city, town, or county towards a similar goal, reach out to Beyond Pesticides by sending an email to info@beyondpesticides.org for one on one assistance and strategies you can use to eliminate unnecessary pesticide use where you live.

SOURCE: Brone, Aigail. "Norwalk bans pesticides on public land—with a few exceptions." *The Hour*. July 1, 2022; Guenther Chapman, Nancy. "Norwalk Council passes pesticide ban." *Nancy on Norwalk*. June 30, 2022

ORGANIC TRANSITION ELEVATED | JUNE 10, 2022

USDA Announces Dramatic Increases in Support for Organic Agriculture without Call for Total Transition

The U.S. Department of Agriculture (USDA) announced on June 1 that it will provide a potential 15-fold increase in funding aimed at organic food production—up to $300 million. The subject Organic Transition Initiative provision is embedded in a new USDA Food System Transformation framework (FSTF), whose *raison d'être* is captured in the press release: "to transform the food system to benefit consumers, producers and rural communities by providing more options, increasing access, and creating new, more, and better markets for small and mid-size producers." That funding for organic transition, the invocation of climate as a significant driver of multiple features of the initiative, and a focus on equity concerns are all welcome news. Beyond Pesticides maintains that it will be critical that this FSTF result in concrete goals that set out specific metrics and timelines—particularly around the magnitude of acres shifted to organic production and the pace of the phaseout of non-organic substances and protocols.

The headline of the press release bespeaks the rationale: "Shoring Up the Food Supply Chain and Transforming the Food System to Be Fairer, More Competitive, More Resilient." Broadly, the initiative addresses four sectors of agricultural activity: production, processing, aggregation/distribution, and markets/consumers.

The FSTF sets out four top-level goals; the appendix to the announcement includes more-detailed sections on each of these:

1. *building a more resilient food supply chain that provides more and better market options for consumers and producers while reducing carbon pollution*; the press release notes that the increase in funding is geared to providing comprehensive supports for farm transition to organic production, including mentoring, comprehensive, wraparound technical assistance, direct funding through conservation financial assistance and additional crop insurance assistance, and support for developing product markets in targeted areas
2. *creating a fairer food system that combats market dominance and helps producers and consumers gain more power in the marketplace by creating new, more, and better local market options*; this section points to the huge reduction in producers' power in the marketplace during the past five decades, due to massive consolidation in the food system, and to the "perils of a food system dominated by a few corporate players"; this initiative, USDA asserts, will "deliver a better deal for farmers, ranchers, growers and consumers"
3. *making nutritious food more accessible and affordable for consumers*; in this section, USDA emphasizes the unacceptability of food and nutrition insecurity, and commits to its elimination
4. *emphasizing equity;* here, the agency says that "rural communities, underserved communities, communities that experience persistent poverty, and the people who live there have been left behind"; it further asserts that the FSTF will create more economic opportunities in such communities and help them keep more of the food system dollar—accelerating more-equitable growth, and helping more of the created wealth remain in small towns and underserved communities

USDA's press release notes that the effort "supports the Biden-Harris Administration's broader work to strengthen critical supply chains as directed by *Executive Order 14017 America's Supply Chains*." Funding for the initiative will come from the *American Rescue Plan Act* (and other pandemic relief legislation), and a good number of the features address "lessons learned from the Covid-19 pandemic and supply chain disruptions caused by Russia's war in Ukraine." USDA has emphasized that this new initiative builds on its 2021 provision of pandemic assistance to cover certification and education expenses for certified organic producers and those making the transition to organic. (See more about pandemic support for farmers here.)

The appendix section (of the USDA press release) on Food Production spotlights two initiatives: the increased funding (up to $300 million) for the new Organic Transition Initiative, and up to $75 million to support urban agriculture. Roughly $20 million for the latter will go to processing a backlog of applications from a 2018 grant program to support urban agriculture; in 2020 and 2021, a mere 6% of applications were processed. Another $40 million will help fund outreach and training programs for urban farmers, which USDA says will "expand access to nutritious foods, foster community engagement, increase awareness of climate change and mitigate the effects within urban areas, provide jobs, educate communities about farming, and expand green spaces." The People's Garden Initiative, recently revived, will get an infusion of

$5 million for 18 flagship gardens across the country, which are used to "grow fresh, healthy food and support resilient, local food systems; teach people how to garden using conservation practices; nurture habitat for pollinators and wildlife; and create greenspace for neighbors."

Other noteworthy features of the initiative include:

- $40 million to support doctors' ability to prescribe fresh—and ideally organic and local/regional—produce, aka, food as medicine for patients who have poor access to proper nutrition
- advancement of economic equity and environmental justice
- $375 million to catalyze more independent poultry and meat processing enterprises (because currently, there are four multinational companies doing all of this in the U.S.)
- a food supply chain loan guarantee program to shore up independent investment in mid-chain operations (e.g., rucking, cold storage, and processing) for meat and poultry
- up to $600 million to support supply chain infrastructure beyond the meat and poultry sector
- funds for food safety certification training for specialty crops
- funds to levy commodity purchasing through the Farm-to-School program and other procurement programs, increasing markets for local/regional farms
- additional support for the Community Compost and Food Waste Reduction Program, and a feasibility study (and corresponding actions) for a National Food Loss and Waste Strategy
- increased funding to a variety of programs focused on access to healthful food—for seniors, those who live in so-called "food deserts," patients with inadequate food and nutrition security (via the "food as medicine" or food prescription initiative mentioned above), students who participate in school feeding programs, and others; also, $25 million to support SNAP (Supplemental Nutrition Assistance Program) technology improvements

There is a big focus on animal food processing in the FSTF, as a response to the pandemic experiences related to this industry. This is hardly an ideal focus in terms of climate impacts because the consumption of animal products represents a significant contribution to greenhouse gas emissions. This is especially true of the giant CAFO (concentrated animal feeding operations) sector and conventional dairy sector, from which most "industrial" meat and dairy products come. This may (or may not) be offset by the multiple other aspects of the FSTF that support local small- and mid-sized, as well as organic and regenerative, farms whose practices have a far smaller climate and environmental footprint.

As the organization Moms Across America points out in its coverage of the FSTF, the initiative may have the additional impact of reducing "the dependency on GMO mono-crops that have been the reason for the destruction of rainforests and sacred lands." The organization could be speaking for Beyond Pesticides when it writes, "Are we naive to the corruption that could result from these hundreds of millions of dollars being doled out to organizations and companies? No. Are we skeptical if the money will merely line the pockets of more Fat Cats? Yes. But is there also a possibility that we have made progress?" But the organization also asks, "Has the food movement educated Tom Vilsack and his team that regenerative organic farming and access to organic food are essential?"

On that last question, Beyond Pesticides must return to its earlier coverage of Secretary Vilsack's unhelpful behavior in 2020, when he used a G20 summit to diss the European Union's Farm to Fork strategy, a primary goal of which is to reduce damaging climate, environmental, and health impacts of agricultural activities, and indirectly, its overall aim to create a "fair, healthy and environmentally friendly food system." At the time, Beyond Pesticides wrote, Secretary Vilsack "chose to counter the F2F efforts by promoting an 'alternative strategy'—under the moniker 'Coalition for Productivity Growth'—through which 'other nations pledge *not* to follow the European path on farm policy.' He has described this alternative, U.S.-led strategy as 'a market-oriented, incentive-based, voluntary system [that] is effective' at slashing agricultural carbon emissions."

This corporate-friendly approach rankled the health and environment advocacy community, but the criticism was not confined to those circles. The staid outlet *Forbes* magazine published an article titled, "Why Tom Vilsack Is Wrong About Farm To Fork and What We Can Do About It." The piece included this: "USDA Secretary of Agriculture Tom Vilsack has recently downplayed the European Union's ambitious Farm To Fork strategy. Farm To Fork [F2F] is the cornerstone of the European Green Deal, and puts sustainability at the heart of the world's largest food import and export market. But Vilsack's dismissal of the E.U. are [sic] out of step with consumer sentiments, food justice advocacy and the latest cutting edge research on agroecology. . . . Vilsack's alignment with agribusiness downplays the vast inequities at the heart of the U.S. food system."

It continued, "The USDA secretary is promoting an alternative strategy called the Coalition for Productivity Growth, based on market-oriented, incentive-based systems. . . . The Vilsack approach is music to the ears of Big Food conglomerates like Bayer, Syngenta, Corteva (Dow/Dupont), Cargill and JBS, as well as trade groups such as Vilsack's former employers at the Dairy Export Council."

Forbes continued to surprise with these comments: "The grassroots sustainability momentum in the U.S. is consistent with recent scientific studies that expose the yield/productivity myth of chemical intensive agribusiness. . . . The European Union Farm To Fork plan is not perfect, but shows that public food system governance is possible and that a sustainable food system is already busy being born. And grassroots efforts in the U.S. are already building such a foundation domestically.

A U.S. Farm To Fork strategy based on good food purchasing principles could ensure that healthy, fresh, affordable food grown and processed with justice, transparency and equity are available to all. Now that would be the way to go."

In a Civil Eats interview that challenged some of the Secretary's previous positions, he said, "This announcement is designed to do is to say, 'We'd like to see that higher-value opportunity [that farmers access through the organic premium] more available and even more easily obtainable.' We know it's a problem: [organic certification is] complicated. It is expensive. It is tough. And they need help. So, here's money to get a mentoring program in place. Here's money to potentially look at ways in which we can either right-size the market where there's too much supply and not enough market or right-size the demand where there's a lot of market but not enough demand, not enough supply. That's what we're trying to do with the $300 million. I think it is a very important signal about the significance and importance we place on organic as part of the overall system." Civil Eats coverage calls the FSTF emphases on regionalism, support for organic and urban farming, and nutrition "a significant shift for the agency, which has historically prioritized efficiency over all else."

Response from elsewhere in the nonprofit world has included this from the Organic Farming Research Foundation's Gordon Merrick, Policy & Programs Manager: "In the past year, OFRF has had numerous meetings with USDA officials and provided in-depth written comments on how the agency can best support farmers and ranchers transitioning to organic production systems. . . . This is a meaningful first step to truly working towards a just and equitable food system. We at OFRF are excited to see the details of this historic investment into the National Organic Program."

Beyond Pesticides advises that, in its development of specific goal metrics and plans, USDA look to the example of EU's F2F plan, particularly in regard to such metrics on transition to organic production and reduction of the use of synthetic inputs (pesticides and fertilizers) on a specified timetable. For example, F2F:

- sets out an objective of moving at least 25% of the EU's agricultural land to organic farming by 2030
- directs major funding to boosting sustainable practices, such as precision agriculture, agroecology (including organic farming), carbon farming, and agroforestry
- establishes the goal of reducing, by 2030, overall use *and risk* of chemical pesticides by 50%, and the use of more-hazardous pesticides by 50%
- makes changes to outdated regulations governing sourcing and use of pesticide data in order to address data gaps and promote evidence-based policymaking

What to make of USDA's (and presumably the Secretary's, given that he is promoting FSTF) apparent shift to greater organic, climate, and equity focus via this initiative? Certainly, the Biden/Harris administration's concerns and priorities about the food system, climate, environment, and equity are a likely and significant impetus. Experiences during the pandemic have clearly been catalysts, as well, including problems such as supply chain issues, transportation problems, staffing shortages, insufficient inventory, and lack of redundancy in systems. Other issues are emerging as a function of the Russian war on Ukraine.

The press release on FSTF concludes with this: "In the Biden-Harris Administration, USDA is transforming America's food system with a greater focus on creating new, more, and better markets to support farmers, ranchers, and consumers. USDA will do this by building more resilient local and regional food production [and] fairer markets for all producers, ensuring access to safe, healthy and nutritious food in all communities, building new markets and streams of income for farmers and producers using climate smart food and forestry practices, making historic investments in infrastructure and clean energy capabilities in rural America, and committing to equity across the Department by removing systemic barriers and building a workforce more representative of America."

Such a values-driven, rather than corporate interest–driven, approach at USDA would be far preferable and appropriate to the needs of people and the planet; perhaps this FSTF signals movement in that direction. Critically, the federal government needs to heed Beyond Pesticides' call for ending our ubiquitous use of toxic pesticides over the next decade, and for protection of strong organic standards and integrity in the National Organic Program and National Organic Standards, with an important feature of those standards being the National List of Allowed and Prohibited Substances, which controls what can and cannot be used in organic crop and livestock production.

What to do: The devil, as always, will be in the details of this new Organic Transition Initiative. For now, Beyond Pesticides is cautiously hopeful that this new injection of funding, and greater focus on the importance of the organic transition, will bear out on the ground —in more acres under organic production and significant reduction in use of synthetic pesticides and fertilizers, as well as for the other environmental, climate, equity, and economic benefits it may engender. Meanwhile, advocacy to ensure strong organic standards with integrity requires a high degree of public involvement and comments. Use Beyond Pesticides Keeping Organic Strong platform to let the National Organic Standards Board and USDA the importance of strong organic standards and enforcement.

SOURCE: U.S. Department of Agriculture. "USDA Announces Framework for Shoring Up the Food supply Chain and Transforming the Food System to Be Fairer, More Competitive, More Resilient." Press Release No. 0116.22. June 1, 2022

COMPOST OUTPERFORMS CHEMICAL FERTILIZER | MARCH 31, 2022

Traditionally Produced Compost Improves Soil, Outperforms Synthetic Chemical Fertilizers

Composts produced using traditional ecological knowledge create healthier, more fertile soil than industrial, chemical-based fertilizers, according to the findings of a recent study published in *PLOS* Sustainability and Transformation. As the dangers posed by industrial agriculture become increasingly apparent, organic and traditional practices show a time-tested path toward a sustainable farming future. According to study author Seema Sharma, PhD, "The research was already there because the ancient people did their research long ago," she said to *EOS*. "But when it comes to the scientific community, you need research that is in a peer-reviewed journal and then finally verified."

The study focuses its comparison within the Kachchh district, a semi-arid farming area of Western India that experiences erratic rainfall and has higher salt levels in its soils than much of the rest of the country. Twenty farms were chosen based on their fertilizer management practices, split between farmers employing traditional composting techniques and those using chemical fertilizers. For the chemical farms, an initial application of animal-based manure was applied, and synthetic sources of nitrogen (urea) and phosphorus (ammonium phosphate) were then spread as a top dressing at a rate of roughly 60kg (132lbs)/ha approximately 20 days after sowing. Traditional farms utilized a compost known as Jivamrit-S (Jeevamrutha), comprised of cow manure, cow urine, jaggery (an unrefined cane sugar), gram flower, and soil that is then fermented in a compost pit. This material was applied once a week for the two weeks after planting, and subsequently watered in. Over the course of three years, farm soils were tested before, during, and after harvest.

The study measured five variables of the soils on the 20 farms, including water holding capacity, bulk density (an indication of how compact the soil is), electrical conductivity (a measure of salts in soil), soil organic matter, and pH. The maximum water holding capacity of traditional farms was on average higher (at 47.5%) than soils amended with chemical-based fertilizers (at 38%). Bulk density recorded lower values in traditionally managed soils (1.04 grams per cubic centimeter) than those chemically treated (at 1.31 grams per cubic centimeter). Most unsurprisingly, traditional soils had lower levels of electrical conductivity (at 0.55 deciSiemens per meter) compared to those that applied salt-based, synthetic chemicals (at 0.69 deciSiemens per meter). Soil organic matter was higher in traditional soils (at 0.75% organic matter) than chemical amended soils (at 0.46% organic matter). pH tended to increase in soils that were chemically treated (averaging 8.1), while those amended with traditional composts recorded relatively stable soil pHs (averaging 7.3).

The study notes that traditional soils maintain their advantages over chemically treated throughout the course of the experiment, and even during a drought period in the middle of study period. "In the present scenario—where chemical fertilizers had already shown detrimental effects in the form of long-term soil fertility depletion, health concerns occurring due to chemical inputs to both the growers and consumers, environmental deterioration—ecologically sustainable agri-management systems are not a choice but a necessity," the study reads.

A similar recent review of cropping practices in Chinese rice paddy farms also found a range of benefits conferred by traditional practices that were not seen under an industrialized, monoculture farming approach. By utilizing traditional techniques that integrate animals into rice farms, nutrient cycling improved, the animals reduced on-farm weed pressure, and total economic output increased by up to 7x in certain conditions. This study represented an "enhanced" version of the traditional approach utilized in this region, adding additional nutrients in the form of vegetable manures.

It is critical that more research be done on the current value of traditional cropping systems, so that modern scientific methods can be applied to further improve these approaches, say health and environmental advocates. They say this approach should form the foundation for future farming practices that are truly sustainable, providing an off-ramp from over-promised "silver bullet" solutions of the agrichemical industry—be they synthetic fertilizers, genetic engineering, toxic pesticide use, or the industry's new focus on RNAi.

Dr. Sharma plans to conduct further research comparing the yields between farming utilizing traditional practices and those employing industrial approaches. "The farmers that I work with are now telling me that we have yields that are on par with the common system of chemical farming," she told EOS. "But that study has to be done."

What to do: For more information on the benefits of time-tested, traditional and organic practices, see Beyond Pesticides organic program page. Consider taking action today to ensure that organic maintains its separation from industrialized agriculture and continues its trajectory of continuous improvement.

SOURCE: Sharma, Seema. "Trend setting impacts of organic matter on soil physio-chemical properties in traditional vis-à-vis chemical-based amendment practices." *PLOS Sustainability and Transformation*. March 1, 2022. https://doi.org/10.1371/journal.pstr.0000007; Chapman, Andrew. "Traditional Fertilizers Beat out Industrial Chemicals in Soil Health Test." *EOS*.March 29, 2022

STATE LAWS INCREASE POLLINATOR PROTECTIONS | JANUARY 6, 2022

Officials in New Jersey and New York Act to Protect Pollinators by Restricting Neonic Pesticides

Officials in New Jersey and New York are taking action to protect their states' declining pollinator populations by restricting outdoor uses of neonicotinoid (neonic) insecticides. In New York, the state Department of Environmental Conservation announced it would make these pesticides "restricted use," and only available to state certified applicators. In New Jersey, A2070/S1016, sponsored by state Senator Bob Smith and Assemblyman Clinton Calabrese, was signed by Governor Phil Murphy last week after years of advocacy from national, state, and local pollinator and environmental groups. "The law relies on the most up-to-date science to ban the largest uses of neonics in the state," said Lucas Roads, staff attorney at the Natural Resources Defense Council. "This is great news for not just pollinators that are poisoned by neonics, but for all the farmers who depend on insect pollination and for all New Jerseyans that value thriving ecosystems."

A2070/S1016 provides for a targeted phaseout of outdoor uses of bee-toxic neonicotinoids, chemicals implicated not only in the decline of pollinators, but also the collapse of entire ecosystems. Beginning 12 months after passage, the bill requires state agencies to classify neonicotinoids as "restricted use." Under this designation, only certified pesticide applicators would be allowed to apply these products, effectively eliminating consumer uses. Then, in late 2023, the bill prohibits all outdoor nonagricultural neonicotinoid uses. Exemptions are limited to veterinarian care, wood preservation, outdoor applications within one foot of a building, and invasive species. The state agriculture commissioner may grant a time-limited exemption for use if an applicator can show that a "valid environmental emergency exists" and that no other less harmful pesticide is available for the given emergency.

New Jersey and Maine have now passed the strongest state pollinator protection laws in the country. While now, in addition to New York, Connecticut, Maryland, Vermont, and Massachusetts have generally removed consumer neonic uses from the market, the NJ and ME bills represent another step forward by eliminating most outdoor nonagricultural uses.

These changes will have major implications for pollinator and ecosystem health, reducing an even greater proportion of dangerous pesticide use. A report published by the NJ Department of Environmental Protection found that

out of 250 surface water samples collected, at least one neonicotinoid was detected in over half of those tested. With even minute exposures to neonic products likely to kill off wild pollinators, any future uses that can be eliminated are a net positive for wildlife.

Although progress protecting pollinators in the U.S. has been slow in comparison to actions taken in the European Union, which has banned all outdoor neonicotinoid uses, including those in agriculture, the pesticide industry has focused considerable resources on halting U.S. policies. A 2020 report, *The Playbook for Poisoning the Earth,* published in *The Intercept* by reporter Lee Fang, details a massive public deception campaign by the pesticide industry, aimed directly at stopping state and federal action to protect pollinators from these highly hazardous insecticides. As part of this playbook, the pesticide industry has worked to cast itself not as promoter of pollution, but as the solution to pollinators' plight. This approach has focused on spinning the science on neonics, diverting attention to preexisting problems in beekeeping, like disease and mites, that are in fact exacerbated by neonic use, and using industry connected farmers, beekeepers, scientists and other influencers in an attempt to confuse lawmakers and the public on the true cause of pollinator declines.

Meaningful action has been diffuse, and only seven states to date have enacted restrictions on neonicotinoid use.

As far back as 2014, Beyond Pesticides asserted that this ongoing pollinator crisis is No Longer a Big Mystery. But meaningful action has been diffuse, and only seven states to date have enacted restrictions on neonicotinoid use. At the federal level, the U.S. Environmental Protection Agency (EPA) merely required noncommittal "managed pollinator protection plans" from individual states (MP3s). These plans handed off the baton to state pesticide lobby groups to address how to protect pollinators; unsurprisingly, pesticide use was not a major component of most of these plans. In fact, in 2019 the agency was cited for its failure to provide basic oversight for these state MP3s, with the EPA Office of Inspector General noting that the agency had no way to evaluate the impact of MP3s and that the agency focused too much on acute risks to pollinators and an insufficient amount on chronic impacts. EPA's inaction and inability to stand up to the pesticide industry means that pollinators and ecosystems continue to suffer throughout most of the U.S.

What to do: State action is urgently needed to fill in the gaps left by EPA inaction, and New Jersey and Maine represent a new high bar for neonicotinoid restrictions. But in the long-term, it is critical to stop all neonicotinoid use in the U.S. and prevent the next round of pollinator toxic chemicals from becoming widespread. The *Saving America's Pollinators Act* (SAPA) would accomplish this goal, side-stepping industry-influenced EPA and allowing a board of pollinator experts to make decisions around pesticide registrations. Ask your elected representative in Congress to support pollinators by cosponsoring SAPA. If they are already a cosponsor, send a thank you for their leadership.

SOURCE: New York State Department of Environmental Conservation. "DEC Announces Actions to Protect New York's Pollinators by Restricting Use of 'Neonic' Pesticides." Press Release. January 24, 2022

MAINE BANS PFAS-CONTAMINATED PESTICIDES | APRIL 19, 2022

Maine Moves to Ban Pesticides and Fertilizers Contaminated with PFAS

Both houses of Maine's legislature have just approved a bill that would, by 2030, ban pesticides that contain PFAS chemicals—the so-called "forever chemicals." The bill's next stop is the Appropriations Committee, for approval of $200,000 in annual funding to enact the bill; if successful there, it will move to the desk of Maine Governor Janet Mills for her signature. [The bill was signed into law on April 20, 2022.] The legislation is one of a suite of lawmaker efforts in the state to address the growing PFAS problem with which localities across the U.S. are struggling. Beyond Pesticides continues its coverage of the scourge of PFAS chemicals, particularly as it relates to pesticide use and the use of fertilizers made from PFAS-contaminated "biosludge" from municipal treatment facilities.

PFAS—"per- and poly-fluoroalkyl substances"—are any of a family of more than 9,000 synthetic chemicals, invented in, and widely deployed since, the 1950s in a multitude of industrial and consumer products. PFAS molecules are made up of a chain of linked carbon and fluorine atoms; the carbon–fluorine bond is one of the strongest chemical bonds that exists, which means that these compounds do not break down in the environment. Scientists cannot even estimate the environmental half-life of PFAS (half-life being the amount of time required for 50% of the compound to degrade and "disappear"). Hence, the "forever chemicals" moniker.

NIEHS (the National Institute of Environmental Health Sciences) notes: "Research on two kinds of PFAS forms the basis of our scientific understanding about this group of chemicals. Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) were manufactured for the longest time, are the most widespread in the environment, and are the most well-studied. Although these two compounds are no longer made in the United States, chemical manufacturers have replaced them with alternative PFAS."

PFAS have emerged during the past decade or so as a serious environmental contaminant and health concern. They represent a scenario characteristic of the poorly regulated use of chemicals in the industrial, military, and commercial materials streams that, ultimately, end up in the environment and human (and other) bodies.

In February 2022, Beyond Pesticides wrote, "There has been precious little activity at the federal level to deal with PFAS. . . . The U.S. Environmental Protection Agency (EPA) announced in 2019 that a 'Comprehensive Nationwide PFAS Action Plan' would be forthcoming. (It has not yet emerged.) Since 1998, EWG [the Environmental Working Group] notes, 'despite mounting evidence of PFAS' toxicity and contamination, EPA has inexcusably dragged its feet. The [agency] has failed to set a legal limit for any PFAS in tap water, and its non-enforceable health advisory level for PFOA and PFOS is 70 times higher than what independent studies show is needed. In 2019, EPA announced a toothless "action plan" that would do nothing to reduce ongoing PFAS releases or clean

up legacy PFAS pollution.'" [Update: The agency has since announced levels of allowable water contamination.]

These chemicals are contaminating waterways, water bodies, and drinking water sources; the food supply; wastewater and biosolids; soils; and now, the bloodstreams of 97% of the U.S. population. Exposure to these compounds has been linked to a variety of human health anomalies, including cancers, kidney dysfunction, neurodevelopmental compromise in children, immunosuppression, preeclampsia, increased risk of cardiometabolic diseases (via exposure during pregnancy), and respiratory system damage—not to mention that it may increase the risk of Covid infection and severity.

Some states have filled the gap left by federal inaction or limited action. Maine has been a particular hotbed of activity. Media has helped: *The Penobscot Times* coverage of PFAS runoff from a Two Rivers Paper Company landfill into the St. John River; the *Press Herald's* reporting on PFAS contamination of Maine fish stocks and wild deer; and publication about research by Northeastern University and the Penobscot Nation on PFAS-contaminated leachate from the Juniper Ridge Landfill.

The problem extends to PFAS in wastewater and solid waste; a University of Maine Cooperative Extension newsletter, quoting a *Penobscot Times* issue, writes: "PFAS is flowing into Maine waters, but no one knows the level of contamination. Treatment plants release millions of gallons of wastewater into Maine's waterways each day that could contain elevated levels of so-called forever chemicals." Indeed, from wastewater and solid waste treatment plants, and from septic systems that discharge the PFAS from consumer product use, PFAS is finding its way into myriad water sources.

For several years running, an Arundel dairy farmer testified to Maine legislators about the ruination of his multigenerational dairy operation by the discovery of PFAS in his water and soils, and in his cows' milk. The farmer attributes the wholesale contamination to the "biosolids" (waste sludge) he had used on his silage crop fields for years through a state program, and/or ash from a nearby paper mill.

Early in 2022, Beyond Pesticides wrote about another Maine farming operation, Songbird Farm in Unity, Maine, which is now facing similar issues. The farmers grow diversified, organic grain and vegetable crops and were stunned to learn that their fields were victims to the legacy use, a quarter century before their tenure on the land (starting in 2014), of contaminated sludge. Now, their water, soil, and produce were all likewise contaminated; their well water has tested at 400 times the state limit.

The owner-operators felt they needed to halt sales of their crops. They now await answers from the state and some kind of way forward. One of the farmers said to WBUR Radio. We're just learning about PFAS contamination in Maine. We're just acknowledging it. It's 30 years old, but we're just recognizing it."

The Maine legislature has moved more quickly in response than have many other states; in its 2019–2020 session, it passed *An Act To Protect the Environment and Public Health by Further Reducing Toxic Chemicals in Packaging*. In 2021, Maine lawmakers passed *An Act To Stop Perfluoroalkyl and Polyfluoroalkyl Substances Pollution*, which bans (in 2023) the sale or distribution of carpets, rugs, or fabric treatments, and in 2030, use of PFAS in all consumer products in the state.

It also passed, as the *Press Herald* reported last year, "Bills . . . with broad, often-unanimous support . . . sett[ing] among the nation's strictest limits on PFAS pollution in drinking water, prohibit[ing] the uncontrolled testing of PFAS-laced firefighting foam, and provid[ing] millions of dollars to detect and clean up contamination." The drinking water legislation established a limit of 20 ppt (parts per trillion) for the six most common types of PFAS; this more protective than the federal government's current "advisory level" of 70 ppt for two PFAS compounds.

Most recently, the legislature has been considering a group of four bills:

- the subject ban on pesticides containing PFAS, effective in 2030
- a ban, effective immediately, on the spreading on farmland of fertilizers derived from treated human waste (a practice previously promoted by the state); such waste is nearly always contaminated with PFAS
- creation of a fund to compensate farmers; that fund is likely to have a starting appropriation of $60–$100 million
- a study of the remediation possibilities for PFAS in landfills

Storage of pesticide compounds in plastic barrels that leach PFAS into the pesticide is one culprit. But as Beyond Pesticides has noted, "Why would PFAS be found in a pesticide formulation? The chemicals can work well as dispersants, surfactants, anti-foaming agents, or other pesticide adjuvants intended to increase the effect of the active ingredient. EPA includes PFAS chemicals in its "Inert Finder" database, and a PEER [Public Employees for Environmental Responsibility] press release indicates that many companies have patents on file for pesticide formulations contain-ing PFAS."

Biosludge products, another culprit, are not only sold to farmers, they are sold as fertilizers for consumer home and garden use. The organization wrote in 2021 that these products not only often contain PFAS, but also, harbor "hazardous pesticides, heavy metals, antibiotics and other pharmaceuticals, personal care products, and a range of other toxicants. . . ."

What to do: Organic practices solve many problems in one fell swoop. Certified organic production and food labeled "USDA Organic" may not be produced with biosolids. Get your locality to act protectively on pesticide use and/or to stop the use of biosolids.

SOURCES: Overton Penelope. "Maine lawmakers approve ban on pesticides containing PFAS by 2030." *Press Herald*. April 12, 2022; Hirschkorn Phil. "Maine legislators move toward final passage of bills restricting PFAS 'forever chemicals.' WMTW. April 13, 2022

CLIMATE FRIENDLY ORGANIC FARMING | DECEMBER 2, 2022

Climate-Friendly Organic Systems Are More Profitable for Farmers than Chemical-Intensive Agriculture

The longest-running—four-decade—investigation comparing organic and conventional grain-cropping approaches in North America is reporting impressive results for organic. Recently announced in the Rodale Institute's *Farming Systems Trial—40-Year Report* are these outcomes: (1) organic systems achieve 3–6 times the profit of conventional production; (2) yields for the organic approach are competitive with those of conventional systems (after a five-year transition period); (3) organic yields during stressful drought periods are 40% higher than conventional yields; (4, 5, and 6) organic systems leach no toxic compounds into nearby waterways (unlike pesticide-intensive conventional farming), use 45% less energy than conventional, and emit 40% less carbon into the atmosphere. Beyond Pesticides reported in 2019 on similar results, from the institute's 30-year project mark, which have been borne out by another three years of the trials.

The current report builds on results from the FST that were shared in the RI's 2020 white paper, *Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming*," which integrated the newest research data and offered action steps for consumers, policymakers, farmers, and others. That report asserted that a global switch to a regenerative food system could not only provide sufficient food for the world's population, reduce chemical exposures, and improve biodiversity, but also, could be key to mitigating the climate crisis.

Through its longitudinal Farming Systems Trial (FST), the Rodale Institute (RI) has collected data that measure differences in soil health, energy efficiency, crop yields, water use and contamination, and nutrient density across test plots of grains grown in organic and conventional systems, and using different levels of tillage. The project focuses on grains (including wheat, corn, soy, and oats) because they represent 70% of U.S. crops.

On its 12-acre Pennsylvania parcel, the institute's FST uses 72 experimental plots, across which are applied three broad approaches:

- **organic manure,** representing a typical organic dairy or beef operation, featuring long rotations of annual feed grain crops and perennial forage crops, fertilized through legume cover crops and periodic applications of composted manure, and using diverse crop rotations as primary defense against pests
- **organic legume,** representing a typical cash grain operation, featuring mid-length rotations of annual grain crops and cover crops, deploying leguminous cover crops as the sole fertilizers, and using only crop rotations as pest defense
- **conventional synthetic,** representing a typical U.S. grain-producing enterprise, using synthetic nitrogen

fertilizer, and controlling weeds with synthetic herbicides (according to recommendations of Penn State University Cooperative Extension)

Each of those three is further divided into "no-till" and "tillage" strategies (tillage being the practice of digging up, turning over, or otherwise agitating the soil with mechanical tools—typically a plow or disc). This yields six different systems in the FST. The RI notes that, "No-till and organic no-till are not created equal. Conventional no-till utilizes herbicides to terminate a cover crop, whereas organic systems use tools like the roller crimper. We have found that organic no-till practices year after year do not yield optimal results, so our organic systems utilize reduced tillage, and the ground is plowed only in alternating years." The RI website adds that, in order to model standard agricultural approaches, GM (genetically modified) crops and no-till were introduced to the conventional plots in 2008 when those techniques became common in the U.S.

Beyond Pesticides has covered the adverse impacts of conventional no-till, which, as noted, generally uses herbicides to knock down cover crops (in addition to using them on the crop plants). This additional herbicide use can actually cancel out any greenhouse gas emissions saved through not tilling, and can accelerate the development of weeds' resistance to the herbicide compounds.

To what to attribute these demonstrated benefits of organic over conventional approaches? All these results, as Beyond Pesticides and the RI have asserted for decades, begin with soil health. "Healthy soil is that which allows plants to grow to their maximum productivity without disease or pests and without a need for off-farm supplements. Healthy soil is teeming with bacteria, fungi, algae, protozoa, nematodes, and other tiny creatures. Those organisms play an important role in plant health [by helping plants fight diseases and pests]. Soil bacteria produce natural antibiotics that help plants resist disease. Fungi assist plants in absorbing water and nutrients. Together, these bacteria and fungi are known as 'organic matter.' The more organic matter in a sample of soil, the healthier that soil is."

Healthy soil retains more moisture, boosting plants' ability to survive periods of drought; it binds together, supporting soil structure that more successfully wards off soil erosion and runoff into waterways. And because organic systems do not use chemical inputs, toxic compounds are not deployed into the environment, and fewer fossil fuels are used (because synthetic pesticides and fertilizers are derived from petrochemicals).

It is well known that organic practices increase organic matter in soils; but FST data show that organic matter (and thus, soil health) in organic systems increases continuously over time, whereas in conventional agricultural systems, this does not happen, and soil health remains essentially unchanged. According to RI, such healthy, organically managed soils allow "15–20% more water to percolate through soils, replenishing groundwater and helping organic crops perform well in extreme weather. More organic matter also means more total microorganisms that make nutrients available to plants for strong growth." The metrics used to determine a soil's health include: the number of microorganisms present in the soil; the ability of the soil to retain water during drought or dry periods; the number and variety of nutrients present; and the quantity of carbon the soil is able to hold. By contrast, a more conventional view of soil sometimes sees it as little more than an "empty matrix" to which (chemical) inputs are added so that plants can survive, rather than as a living, evolving, and interactive ecosystem that provides a rich growing environment for plants and many other life forms.

The FST stands out as a singular research approach for multiple reasons, but chief among them is its longevity. RI explains that, "Short-term studies that take place over only a few years can't measure longer-term weather effects, like drought, that will inevitably occur, or biological changes to the soil, which can happen slowly. We need long-term studies to find real solutions to problems affecting the future of global food production."

These results were good news three years ago; they emerge as even more important as the world grapples with a constellation of intersecting environmental and health crises. Many of those are related to the use of synthetic pesticides and fertilizers, and are showing up as degraded soils, biodiversity loss, widespread chemical pollution, and compromised human and ecosystem health. These toxic compounds also play a role in exacerbation of the climate crisis. These realities challenge governments, institutions, businesses, and human populations to change "business as usual."

The Rodale Institute posits, in its 2020 report, *Regenerative Agriculture and the Soil Carbon Solution*, that humans could sequester more than 100% of global, annual, human-caused CO_2 emissions if all global arable and grass lands were transitioned to regenerative systems, and that "stable soil carbon can be built quickly enough to result in a rapid drawdown of atmospheric carbon dioxide." The organization adds to that the importance of shifting to *organic* regenerative systems.

What to do: Beyond Pesticides is calling for the transition off of petroleum-based pesticides and fertilizers within the next decade, and transition to a society and world committed to organic practices. See Beyond Pesticides' recent seminar, Tackling the Climate Emergency. The presenters included Rodale Institute's Andrew Smith, PhD and coauthor of several landmark reports on soil biology and carbon sequestration—including the just-released *Farming Systems Trial—40-Year Report*, and Rachel Bezner Kerr, PhD, a Cornell University professor, and a coordinating author of the United Nations report, Climate Change 2022: Impacts, Adaptation and Vulnerability.

SOURCE: Rodale Institute, Farming Systems Trial: 40-Year Report. 2022.

Let's Raise Our Voices Together
for a Livable Future

THE SEVEN WAYS

1. Know the simple facts

We don't need toxic pesticides and fertilizers that contribute to health threats, biodiversity collapse, and the climate crisis. Get the facts from Beyond Pesticides at **bp-dc.org/resources**.

2. Take action in your community

We support your advocacy (**bp-dc.org/tools**) and the development of organic parks and playing fields in your community (**bp-dc.org/sustainable-parks**). Use our factsheets, like the *40 Most Commonly Used Lawn Pesticides*, **bp-dc.org/40lawnpesticides**, and others.

3. Stay Informed

We simplify access to key science and policy issues in real time through our Weekly News Update, **bp-dc.org/sign-up**.

4. Exercise your voice for national and global change

Take action with a click, using our Action of the Week. Sign up at **bp-dc.org/sign-up**.

5. Follow us on social media

Connect with us on Facebook, Twitter, Linkedin, and Instagram. Share our posts to your own networks to get the word out.

6. Become a member

We have more impact when we work together. Join Beyond Pesticides and strengthen our collective voice to protect health and the environment at **bp-dc.org/join**.

7. Support local groups and Beyond Pesticides with a larger donation

There are so many ways that you can respond to need for urgent action. Beyond membership, consider a larger donation to Beyond Pesticides at **bp-dc.org/donate**.

And there are more ways to give

- **Stock gifts, honorary gifts, inheritance or legacy gifts, IRA gifts, donor-advised funds** and other tax-deductible options will help you support our mission.
- **Workplace giving:** Pre-tax payroll giving programs are often available at your workplace. If not, we can help you set one up.
- **For more ways to give**, please contact Jeff France at 202.543.5450, **jfrance@beyondpesticides.org**.

BEYOND PESTICIDES
701 E Street, SE, Washington, DC 20003
202-543-5450 phone • 202-543-4791 fax
info@beyondpesticides.org • beyondpesticides.org

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■ **TRANSFORMATIVE CHANGE 2022**
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Beyond Pesticides provides free hands-on support to advocates and local municipalities to transition to organic land management—and end petrochemical pesticide and fertilizer use. With organic community parks, playing fields, and open space, we advance the solution to catastrophic health threats, biodiversity collapse, and the climate emergency. It starts in your town/city/county with the technical support Beyond Pesticides offers.

Because of the generosity of Beyond Pesticides' supporters, there is no cost to get started—just a commitment to a livable future. Join with us. Go to Parks for a Sustainable Future at bp-dc.org/sustainableparks, or info@beyondpesticides.org, or 202-543-5450.

Stay Connected with Beyond Pesticides

info@beyondpesticides.org | 202.543.5450 | www.beyondpesticides.org