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Pesticides *and* You

While France Bans a Common Endocrine Disrupting Pesticide, EPA Goes Silent

U.S. ignores statutory mandate to review pesticides that cause deadly illnesses at minute doses, defying classical toxicology

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Glyphosate Roundup: Victims-3, Monsanto/Bayer-0

Two billion and multi-million dollar jury verdicts for health damages

Organic Systems—The Path Forward

Public health threats of foodborne diseases are curtailed through soil health

Tracking Biodiversity: UN Documents Accelerating Biodiversity Loss Threatening All Life

Ecosystem protections and transformative change urgently needed



Transformative Change from the Ground Up

Beyond Pesticides' National Forum in April affirmed the spirit and vision of bringing together the energy of local advocacy with those working in the scientific community, as we all work with policy makers and those who practice the critically needed alternative—organic land management. The conference hit at the core of the needed transformation: *Organic Strategies for Community Environmental Health: Eliminating pesticides where we live, work, learn and play.* We co-convoked the conference with the Children's Environmental Health Center of the Icahn School of Medicine at Mt. Sinai, and joined by Columbia University's Children's Environmental Health Center. (See bp-dc-org/Forum2019.)

Seeing change in action

Our visit to an organically managed public park, which includes a small urban farm, perennial garden, and turf and treed areas, represents the vision for municipalities across the country. And our visit with youth managing organic urban farms at public housing developments exhibited the skills acquired by the young leadership team and the community's engagement in producing wholesome food in sync with nature.

Speaking out to end pesticide poisoning

We were honored to have Dwayne "Lee" Johnson join us for a spirited discussion after a showing of the new film *Ground War* with the filmmaker, Andrew Nisker, and organic turf expert and Beyond Pesticides board member, Chip Osborne, and Ling Tan, a parent who fought successfully with the local group Safe Grow to pass legislation banning toxic lawn pesticides in Montgomery County, Maryland. Mr. Johnson, a former groundskeeper who applied Roundup and became terminally ill from non-Hodgkin lymphoma, exhibited his commitment to speaking out. The film is a moving depiction of a son's quest for answers about his father's cancer, which takes him into the world of doctors, scientists, pesticide regulators, victims of pesticide poisoning, activists, and land managers. The issue is exposure to pesticides used to manage lawns, playing fields, and golf courses and the father's exposure as an avid golfer—then landing on a solution in the work of activists and organic land managers.

The film is particularly timely with public controversy about the use of the weed killer glyphosate (Roundup) and three lawsuits with a two billion and multimillion dollar jury verdicts since August 2018 for compensation and punitive damages against its manufacturer, Monsanto (Bayer)—while thousands of lawsuits are pending. All of this widespread pesticide exposure is taking place in the face of inaction by the U.S. Environmental Protection Agency and headlines pointing to officials sidestepping the law. This is occurring as local jurisdictions consider legislation to stop all toxic pesticide use in their parks and public spaces.

Honing our strategy

The cross-cutting adverse effects of toxic pesticides to air, water, land, people, and wildlife call for an immediate response at the community level—as we consider management decisions that are being made daily by local governments, school and park districts, private institutions, and households. With action to eliminate the use of pesticides in land and building management and the adoption of ecological-based organic practices, we begin to reverse the pending catastrophic events destructive of the ecosystems that support life—exemplified by the dramatic decline in pollinators (the "insect apocalypse") and the climate crisis.

The solutions require a broader community understanding of what is known and still unknown about the delicate balance that is disrupted when toxic chemicals are introduced into living systems. Bringing that scientific knowledge and the clear uncertainty of basic complex interactions—such as exposure to mixtures of chemicals and the impacts on soil and aquatic food webs of life—to every decision on a pesticide use is central to the accountability and transparency required of decision makers.

In this context, this issue of *Pesticides and You* uncovers the limitations of current statutes and regulations governing pesticide use by investigating the failure of EPA to launch a Congressionally mandated program to test for and regulate endocrine disruptors. EPA sits motionless while France and other countries move to ban one of the most widely used fungicides because of its endocrine disrupting effects. Another article in this issue identifies a related benefit of organic management practices—natural and better management of foodborne diseases.

Biodiversity, critical to life

As is pointed out in a new United Nations report, covered in this issue, the need for change is urgent. The UN report says we need "new initiatives that more effectively enlist individual and collective action for transformative change." Continuing, "transformative change can expect opposition from those with interest vested in the status quo but such opposition can be overcome for the broader public good." To that end, we support effective action that leads to rigorous use of the democratic decision-making process. With this, communities stop toxic pesticide use, recognizing the hazards and uncertainties, and adopt organic practices compatible with nature and the complex biological systems that support life.

Let us know how we can support your community.

Jay Feldman,
executive director of
Beyond Pesticides





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Can Synthetic Fertilizers Be Part of My Pesticide-Free Yard?

I'm trying to go pesticide-free in my yard, but this is a pretty recent attempt and I've still got a lot of leftover fertilizer and pesticides from my "conventional" days. I know I'm going to get rid of the pesticides at an upcoming pesticide disposal event in my community. Should I also get rid of the urea-based nitrogen fertilizers, and only go for the natural or organic stuff now? What's the history with these chemicals—and how are they different than the more natural products?

Chuck, Princeton, New Jersey

Hi Chuck,

We're really happy to hear about your efforts to go pesticide-free in your yard. The use of synthetic fertilizers can be traced back to the early 1900s, when chemists Fritz Haber and Carl Bosch developed a process to fix nitrogen from the air into ammonia. This discovery ushered in a new era of petroleum-based industrial fertilizers and reshaped agricultural production throughout the world. The rapid adoption of these products in chemical-intensive farming quickly led to their regular use on turf grass, as producers started marketing these cheap chemicals to homeowners looking for a perfect lawn. But this has come with significant downsides, including risks to public health, soil degradation, and the pollution of local waterways. The production and use of these fertilizers also contribute to the ongoing climate crisis. The Haber-Bosch process requires significant amounts of energy. Once applied, synthetically fertilized soils are prone to release nitrogen oxides—potent greenhouse gases that have upwards of 300 times the heat trapping capacity of carbon dioxide. Additionally, the treated soil does not readily absorb or sequester carbon in the atmosphere—thereby eliminating an opportunity to slow climate change.

Synthetic fertilizers are plant available nutrients, meaning they are in a form that allows immediate uptake by the plants. The fast action of synthetic fertilizers can provide lawns with a quick "green up," but nutrients that do not reach plant roots continue to work their way through the soil and can eventually reach local waterways. This runoff causes nitrate and nitrite pollution that contaminates drinking water. And elevated nitrate concentrations in drinking water has been linked to methemoglobinemia (blue baby syndrome), birth defects, cancers, and thyroid problems, even at levels below EPA allowable limits.

Salt-based synthetic fertilizers are also simply bad for your lawn. High levels of nitrogen in these fertilizers cause microbes in the soil to go into a "feeding frenzy," and rapidly deplete organic matter, including natural soil nitrogen and carbon sources. This has the effect of degrading soil structure, which can increase the potential for erosion, and decrease water penetration.

For these reasons, we suggest weaning your lawn off of synthetic fertilizers as soon as it is practical. When we



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talk about natural organic fertilizers, our focus, rather than feeding plants, is to feed the soil. Microorganisms in the soil will slowly break down organic matter into nutrients that are available to plants. This steady provision of nutrients ensures that plants get the amount they need when they need it, making it much less likely to result in groundwater leaching and other forms of environmental contamination. And rather than contribute to climate change, natural fertilizers and organic practices can be part of the solution. By building up organic matter and microbial life, research finds that organic soils can store over 25% more carbon than synthetically fertilized soils.

The more you can support the microbial life in your soil, the less need you'll have for any fertilizer use. Buying a truly natural fertilizer can be somewhat complicated, since the only labeling requirement on an "organic" fertilizer is that it contains carbon. For help getting started, visit Beyond Pesticides' website for a list of certified organic fertilizer or soil amendment companies that manufacture products compatible with organic landscape management (See *Products Compatible with Organic Land Management* at bp-dc.org/organiccompatible). Other techniques to reduce fertilizer use include leaving grass clippings on your lawn, and planting clover or microclover. In many areas of the country, this combination can provide nearly all the nitrogen your lawn needs for the year. We

SHARE WITH US!

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

applaud your work to go pesticide-free in your yard. If you ever need additional guidance, visit Beyond Pesticides' Lawns and Landscapes program page for more information, bp-dc.org/lawns.

A Toxic Business Model

I am curious if there is any new information regarding the increasing prevalence of residential mosquito spray companies (e.g., Mosquito Authority, Mosquito Hunters, Mosquito Joe, etc.), and the possible effect of the pesticides on pollinators? My neighbors are having their property fogged every three weeks! I have tried talking to them, and providing them with information and alternatives, but they are not interested in considering anything other than fogging every three weeks. Are there local laws that can address this?

Rebecca, Indianapolis, Indiana

Hi Rebecca,

We're very sorry to hear about your neighbor's spraying. In addition to human health effects, the pesticides used for mosquito control do pose a significant threat to pollinator populations. More often than not, mosquito spray companies base their business model on the use of synthetic pyrethroid insecticides. Research finds that these chemicals can disorient pollinators, making it difficult for them to find their way back to their hive. They can also weaken hives by reducing bee movement and decreasing social interaction. Even as part of a community-wide vector control program, these pesticides should only be considered in the event of a public health emergency that presents an imminent threat to public health, and then only as a very last resort after alternatives have been tried.

We empathize with your situation with your neighbors—it is a story we hear all too often at Beyond Pesticides. Many, but not all, of these companies will offer a "natural" or "least-toxic" option upon request. Usually, this means they will spray a garlic oil or other repellent around the property.

You can also work to encourage other neighbors to practice safe community mosquito prevention. The more folks you can have regularly dumping standing water, or using mosquito larvacide dunks in areas that do not drain, the fewer mosquitoes in the neighborhood. This will decrease the perceived need to spray, especially if other neighbors are seeing encouraging results and spreading the good news throughout the community. We have seen success with volunteer efforts door-knocking campaigns, or using the Nextdoor network to ask folks to take a "pledge" to stop using toxic pesticides on their property. If you do that, we encourage you to form a group and give yourselves a name, so that it takes pressure off of you as an individual advocate and brings the neighborhood and community together in these collective efforts. Unfortunately, in most states, local towns and communities are preempted (prohibited by state law) from passing laws that stop pesticide use on private property, and local laws do not tend to restrict mosquito spraying. Therefore, spray

companies must be reined in at the state level, where they use their significant resources to fight legislation that would curtail use in favor of nontoxic and preventive practices.

You can purchase our mosquito doorknob hangers to jump-start your outreach efforts to neighbors. Go to shop.beyondpesticides.org. This is a great way to raise awareness in the neighborhood of the hazards of pesticides and the availability of alternatives. As with any organizing effort, the best predictor of success is persistence, so we hope you will continue to work at it and contact Beyond Pesticides with any further questions.

FROM THE WEB

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

Excerpt from Beyond Pesticides Daily News Blog (5/3/2019): *State Court Upholds the Right of Local Governments in Maryland to Restrict Pesticides on All Lawns in Their Jurisdiction.* A Maryland Court of Special Appeals ruled that Montgomery County, Maryland has the right to restrict pesticides, under a 2015 landmark law, on all lawns and landscaped property in its jurisdiction more stringently than the state. The chemical lawn care industry has appealed.

Laurie E. comments: Yes! Finally, common sense prevails to help protect our children and their vulnerable developing nervous and endocrine systems.

MargaretAnne H. comments: Very important decision—allows local governments to make decisions about pesticides and not be preempted by state. Yeah for Maryland. We need this in Pennsylvania.

Excerpt from Beyond Pesticides Daily News Blog (3/4/2019): *Take Action—Saving America's Pollinators Act Reintroduced in Congress.* Last week, U.S. Representative Earl Blumenauer (D-OR) reintroduced the *Saving America's Pollinators Act* (H.R.1337) to cancel specific bee-toxic pesticides and establish a review and cancellation process for all pesticides that are potentially harmful to pollinators.

Carol T. comments: We've destroyed the soil's fertility with chemicals, requiring more chemicals and more water. We have greatly harmed our own health, and now we are killing the pollinators. The magnitude of this should frighten us all. By protecting the pollinators, we will begin to heal the soil, and healthier soil requires less inputs, which will result in healthier people. So, please protect the pollinators.

Call for End to Antibiotic Use in Crop Production, as Worldwide Resistance Crisis Escalates

In a campaign to stop the use of antibiotics in U.S. crop production, Beyond Pesticides, in May, submitted comments with thousands of people and organizations, urging EPA to reject the registrations of streptomycin and oxytetracycline. Beyond Pesticides had secured an extension on the public comment period on the chemicals' registration, after the agency failed to provide adequate public notice of its deliberations.

Since the EPA's 2006 review, there has been a dramatic expansion of research into the microbiome, resulting in a better understanding of its critical roles in regulating such diverse processes as metabolism, immunity, and neuro-development. EPA does not assess risks

due to disruption of the gastrointestinal microbiome. EPA also does not comprehensively consider risks to workers.

Crucially, use of streptomycin and oxytetracycline in agriculture contributes to the growing crisis in antibiotic resistance. Many bacterial infections are becoming resistant to the most commonly prescribed antibiotics, resulting in longer-lasting infections, higher medical expenses, and the need for more expensive or hazardous medications. The development and spread of antibiotic resistance are the inevitable effect of the use of antibiotics. Bacteria evolve quickly, and antibiotics provide strong selection pressure for those strains with genes for resistance.



Spraying crops with these antibiotics promotes multiple drug resistance—making other antibiotics ineffective as well. Resistance genes may be taken up by other bacteria through a number of mechanisms, collectively known as “horizontal gene transfer.” Certified organic production does not permit the use of antibiotics in agriculture.

Beyond Bees: Widespread Hazards Linked to Neonicotinoid Insecticides

CONNECTION TO BREAST CANCER . . .

If the pollinator and ecosystem effects of neonicotinoid insecticides were not sufficient reason for regulatory action, a study published in *Environmental Health Perspectives* finds that environmental concentrations of thiacloprid and imidacloprid increase expression of a gene linked to hormone-dependent breast cancer. Adding to previous work in 2015, the authors of “A Potential Mechanistic Link between Neonicotinoid Insecticides and Hormone-Dependent Breast Cancer,” uncovered a pathway through which neonicotinoids stimulate excess estrogen production, known to occur during the development of progressive hormone-dependent breast cancer.

First author Elyse Caron-Beaudoin, PhD, said, “This provides in vitro evidence that neonicotinoids can be endocrine disruptors and that aromatase may be one of their targets. Importantly, the promoter switch occurs at concentrations that are highly relevant to humans.”

As broad-spectrum insecticides that are incorporated into plants through uptake into their vascular system, beneficial soil dwelling insects, benthic aquatic insects, grain-eating vertebrates, along with pollinators are victims of these systemic neonicotinoid chemicals.

. . . AND TO WILDLIFE EFFECTS

Researchers have found that tiny amounts of neonicotinoids cause migrating songbirds to lose their sense of direction and become emaciated. Now, a two-year study, “Effects of Neonicotinoid Insecticides on Physiology and Reproductive Characteristics of Captive Female and Fawn White-tailed Deer,” published in *Nature Scientific Reports*, finds that field-relevant contamination with imidacloprid causes reduced body weight and metabolism in white-tailed deer, and mortality in fawns. The study evaluates behavioral outcomes of imidacloprid contamination in 80 white-tailed deer housed in a South Dakota State University captive research

facility. Background neonicotinoid exposure of untreated deer in the control group—attributed to background contamination of corn- and soy-based feed, and vegetation contaminated from nearby agricultural use—did not compromise the study findings. Researchers found that imidacloprid levels detected in the spleens of treated and control animals are significantly predictive of reduced thyroid hormone levels, shorter jawbones, lower activity levels, and higher fawn mortality.

The accumulating evidence of neonicotinoid-induced endocrine disruption is of particular concern, given that these insecticides are ubiquitous in the environment. A 2018 study by the U.S. Geological Survey (USGS) found neonics widespread in the Great Lakes at levels that harm aquatic insects—the foundation of healthy aquatic ecosystems. Earlier, a USGS and University of Iowa study found two metabolites of imidacloprid in drinking water that have never been detected previously.

Rollbacks Continue at Interior and EPA

With the confirmation of David Bernhardt, a former oil and gas industry lobbyist, as Secretary of Interior in April, the agency is continuing to weaken the protection of endangered species. A month after taking the leadership position, having served as acting since January after holding lower level positions in the agency, the Center for Biological Diversity (CBD) filed four lawsuits challenging the Trump administration's failure to release a trove of documents detailing how it is regulating dangerous pesticides, especially as they relate to endangered species. Meanwhile, the U.S. Environmental Protection Agency (EPA) released a set of proposed changes to endangered species risk assessments that will dramatically reduce protections for the nation's most endangered plants and animals from pesticides known to harm them. The proposals ignore the real-world, science-based assessments of pesticide hazards, instead relying on arbitrary industry-created models.

The EPA proposals would, for example, gut protections for endangered plants that are pollinated by butterflies and other insects by ignoring the fact that animals routinely move back and forth between agricultural areas and places where endangered species live.

The proposals follow intensive efforts by Secretary Bernhardt to halt federal work on protecting wildlife from pesticides. They were released over a year after a draft biological opinion that was scuttled by the Trump administration found that the loss of pollinators from the insecticide chlorpyrifos would put hundreds of endangered species on a path to extinction.



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Funding Threatened for Children's Environmental Health Centers

After two decades of cosponsoring and co-funding research centers that do important scientific investigation related to children's health, the U.S. Environmental Protection Agency (EPA) and the National Institute of Environmental Health Sciences (NIEHS) are planning to end their support. EPA has announced that it will not renew its grants to these centers, which have operated in California, Colorado, Illinois, Michigan, Iowa, Ohio, Georgia, North Carolina, Maryland, New Jersey, New York, Rhode Island, Massachusetts, and New Hampshire.

As of July, they will lose a huge portion of the funding that has allowed them to deploy hundreds of scientists—in genetics, toxicology, and neurodevelopment—on comprehensive and longitudinal studies of the factors in children's experiences and communities that impact their health. These centers are critical in uncovering the relationships between children's exposures to toxic chemicals, including pesticides, and diseases and health anomalies

later on in their developing years.

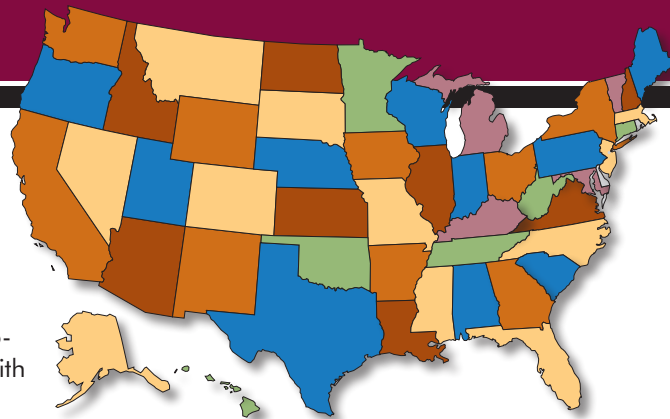
This announcement represents another attack by the Trump administration on science, public health, and children and families, as well as another wink and nod to industries whose products cause harm. Says Trac-



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ey Woodruff, PhD, who runs the University of California, San Francisco Pregnancy Exposures to Environmental Chemicals Children's Center: When EPA weighs the harms of a chemical against its benefits, this "works out perfectly for industry.... If EPA doesn't know, it counts for zero." The centers are very concerned that EPA's withdrawal of support will force them to shutter important, long-term research projects.

The studies conducted by these centers often begin before birth and follow subjects through childhood and into adulthood, yielding unusually rich data that can track, for example, environmental exposures early in life and subsequent and related health problems years later. In addition, these longitudinal studies can adapt to the changing mixes of exposure risks children may face over 20 years or so as they grow from newborns to young adults. The centers produce work that often leads to reform in policies and practices, and, ultimately, improved health outcomes.



Local Restrictions Upheld In Maryland

A long-held democratic principle central to a constitutional democracy—the authority of local government to protect public health and safety, as communities have done historically with ordinances on recycling, smoking, zoning, and dog waste—was upheld by Maryland Court of Special Appeals. The ruling, which reverses a lower court decision in August 2017, found that Montgomery County, Maryland has the right to restrict pesticide use on private property, under its 2015 landmark law. The case was brought against the county by the landscape and chemical industry and individuals who work for the industry. The chemical industry has fought for

nearly three decades to suppress the right of local governments in the U.S. to protect public health and safety with pesticide law, having successfully lobbied 43 states to preempt their local political subdivisions' authority. Seven states uphold local authority, including the state of Maryland, which has affirmed in its legislature the rights of localities by rejecting preemption legislation on numerous occasions. A number of states are looking at reversing state preemption of local municipalities. The U.S. Supreme Court, in *Wisconsin Public Intervenor v. Mortier* (1991), affirmed local authority

to exceed state and federal standards under federal pesticide law.

“This important state court decision affirms local democratic decision making to protect health and the environment, upholding the first U.S. county law to ban toxic pesticides used on lawns on both private and public property,” said Jay Feldman, executive director of Beyond Pesticides.

Autism Linked to Wide Range of Commonly Used Pesticides

Exposure to commonly used pesticides in the womb and during the first year of life is linked to a higher risk of developing autism, according to the study “Prenatal and infant exposure to ambient pesticides and autism spectrum disorder in children: population based case-control study,” published in the journal *BMJ* in March. The study adds to previous findings highlighting autism risks from pesticide exposure and reinforces calls to limit pesticide exposure during early life critical windows of vulnerability. The authors note their findings “support the need to avoid prenatal and infant exposure to pesticides to protect the developing child’s brain.”

Researchers used data from California’s 1998–2010 records of autism disorder diagnosis and birth rates, a control group of approximately 35,000—adjusted for confounding factors that can influence the results, such as the mother’s age, socioeconomic status, and exposure to air pollution. Exposure data was then drawn from California’s agricultural pesticide use database, focusing on 11 pesticides (glyphosate, chlorpyrifos, diazinon, acephate, malathion, permethrin, bifenthrin, methyl bromide, imidacloprid, avermectin, and myclobutanil) applied within 1.25 miles of study subjects’ homes.

Results show modest increases in autism risk for exposure to glyphosate, chlorpyrifos, diazinon, malathion, avermectin and permethrin. For cases of autism with co-occurring intellectual disabilities, a more robust link was found for glyphosate, chlorpyrifos, diazinon, permethrin, methyl bromide, and myclobutanil. A similar link was found for exposures



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within the first year of life, with glyphosate revealing the strongest association—increasing the risk of autism by 50% for exposures occurring during infancy.

Previous studies have linked prenatal and early life pesticide exposure to autism and learning disabilities. A 2014 study found that pregnant women living less than a mile from crops sprayed with organophosphate insecticides have a 60% increased risk of their child receiving an autism diagnosis. For women in the second trimester, chlorpyrifos exposure increases autism risks by 3.3 times. Exposure to synthetic pyrethroids, such as permethrin and bifenthrin, during the last trimester of pregnancy corresponds with an 87% increased risk of an autism diagnosis. A 2017 study found that those living in zip codes where pesticides are aerially sprayed for mosquitoes with synthetic pyrethroids are 37% more likely to have higher rates of children diagnosed with autism and other developmental delays.

By passing the Healthy Laws Act, 52-14 (2015), the Montgomery County Council acknowledged growing demand within the community for natural and organic lawn care practices and compatible products. These cost-effective lawn care methods have been shown to eliminate the need for toxic pesticide use through improvements in soil biology that support more resilient plants.

Meanwhile, a study, "Anti-community state pesticide preemption laws prevent local governments from protecting people from harm," supported by USDA's National Institute of Food and Agriculture, finds that state pesticide preemption laws "compromise public health and economic well-being" by preventing localities from enacting pesticide use restrictions on private property that are more restrictive than their state's regulations.

States Ban Pesticide, EPA Refuses to Act

The banning of the neurotoxic insecticide chlorpyrifos in three important agricultural states shows the states filling some of the void left by EPA inaction. Hawai'i banned chlorpyrifos a year ago with a unanimous vote of the legislature. New York and California banned it in May. Other states have been pursuing bans since EPA rescinded its proposed ban in 2017.

Like other organophosphate pesticides, chlorpyrifos has been linked to damaging and often irreversible health outcomes in workers, pregnant women, and children. A widely used pesticide, agriculture companies annually spray six million pounds on crops like citrus, apples, and cherries. Chemically similar to the nerve agent Sarin gas, the substance was initially developed prior to World War II as a pesticide and chemical weapon. It overstimulates the nervous system to cause nausea, dizziness, confusion, and, in high exposure cases, respiratory paralysis and death.

In the paper, "Organophosphate exposures during pregnancy and child



Joan Cusick for Californians for Pesticide Reform

neurodevelopment: Recommendations for essential policy reforms," published in the journal PLOS Medicine, a group of leading toxics experts is calling for a ban on organophosphate pesticides. The study evaluates current science on the risks of this class of compounds, produced by Corteva Agriscience (formerly Dow AgroSciences). The authors conclude that: (1) widespread use of organophosphate (OP) pesticides to control insects has resulted in ubiquitous human exposures; (2) acute exposures to OPs is responsible for poisonings and deaths, particularly in developing countries; and (3) evidence demonstrates that prenatal exposures, even at low levels, put children at risk for cognitive and behavioral deficits, and neurodevelopmental disorders. Because of adverse effects to children, EPA negotiated a December 2001 cancellation of residential and community chlorpyrifos use, with the exception of golf course and public health mosquito uses, but retained most agricultural uses.

While the campaign to remove chlorpyrifos and other specific pesticides, like glyphosate (Roundup), from the market eliminates a hazardous exposure to vulnerable population groups and workers, the industry typically shifts to other equally hazardous pesticides allowed under weak federal and state

pesticide laws, according to advocates. As a result, communities across the country have adopted or are considering local ordinances that put organic land management practices in place.

Nutrient Runoff, Aquatic Weed Killers, and Florida's Red Tide Collide in Public Debate

After a brief hiatus, the Florida Fish and Wildlife Conservation Commission (FWC) is continuing use of aquatic herbicides, including glyphosate, for invasive species management. Public pressure and feedback caused FWC to take a temporary pause from spraying while the commission collected public comment through public hearings and emails from late January through February. FWC ultimately decided to resume spraying invasive species, and points to its improved integrated management system as reducing overall herbicide use.

Glyphosate, one of the 17 aquatic herbicides that FWC uses regularly, has sparked opposition from environmentalists and the general public due to its wide usage and known adverse effects. According to FWC data, 12,263 pounds of glyphosate-based herbicides



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were used on Florida's Lake Okeechobee in 2017.

About 175,000 people have signed a North Palm Beach petition entitled "Stop the State-Sanctioned Poisoning of Our Lakes and Rivers!" The petition decries the use of glyphosate to kill invasive aquatic plants and warns of subsequent nutrient pollution caused by decay. An excess of nutrients (e.g., nitrogen and phosphorus) from synthetic fertilizers in water bodies contribute to algal blooms. Eutrophication can eventually result in oxygen depletion and thereby decrease biodiversity. FWC denies that the invasive species management program

contributes to either red tide (discoloration caused by an explosion of algae) or blue/green algae buildup, citing lack of evidence and asserting that keeping low populations of the plant reduces buildup of decaying plant material.

Those who use alternatives say that employing nonchemical strategies requires different approaches than chemical-intensive strategies. For example, timing of harvesting and the use of biological controls becomes an important factor in efficacy of these nonchemical approaches.

Fungicides Linked to Disease Resistance and Adverse Effects

Long known to be among the most hazardous pesticides, a widely used agricultural fungicide worldwide is being restricted in Europe. Fungicide use on farms is being linked to the threat of the deadly fungal pathogen, *Candida auris*, which is advancing across the globe.

DEADLY RESISTANCE EMERGING

Dutch researcher Jacques Meis, M.D., Ph.D., Department of Medical Microbiology and Infectious Diseases, Canisius Wilhelmina Hospital, says that drug-resistant fungi are developing because of heavy use of fungicides on crops. He first saw the resistance and agricultural link when a patient in the Netherlands died in 2005 from the fungus *Aspergillus*, which proved resistant to the antifungal itraconazole—that compound being a virtual copy of the azole fungicides used worldwide to treat crops, and accounting for more than one-third of all fungicide sales. (See PAY, p. 9.)

EUROPE BANS CANCER CAUSING, FROG-KILLING FUNGICIDE

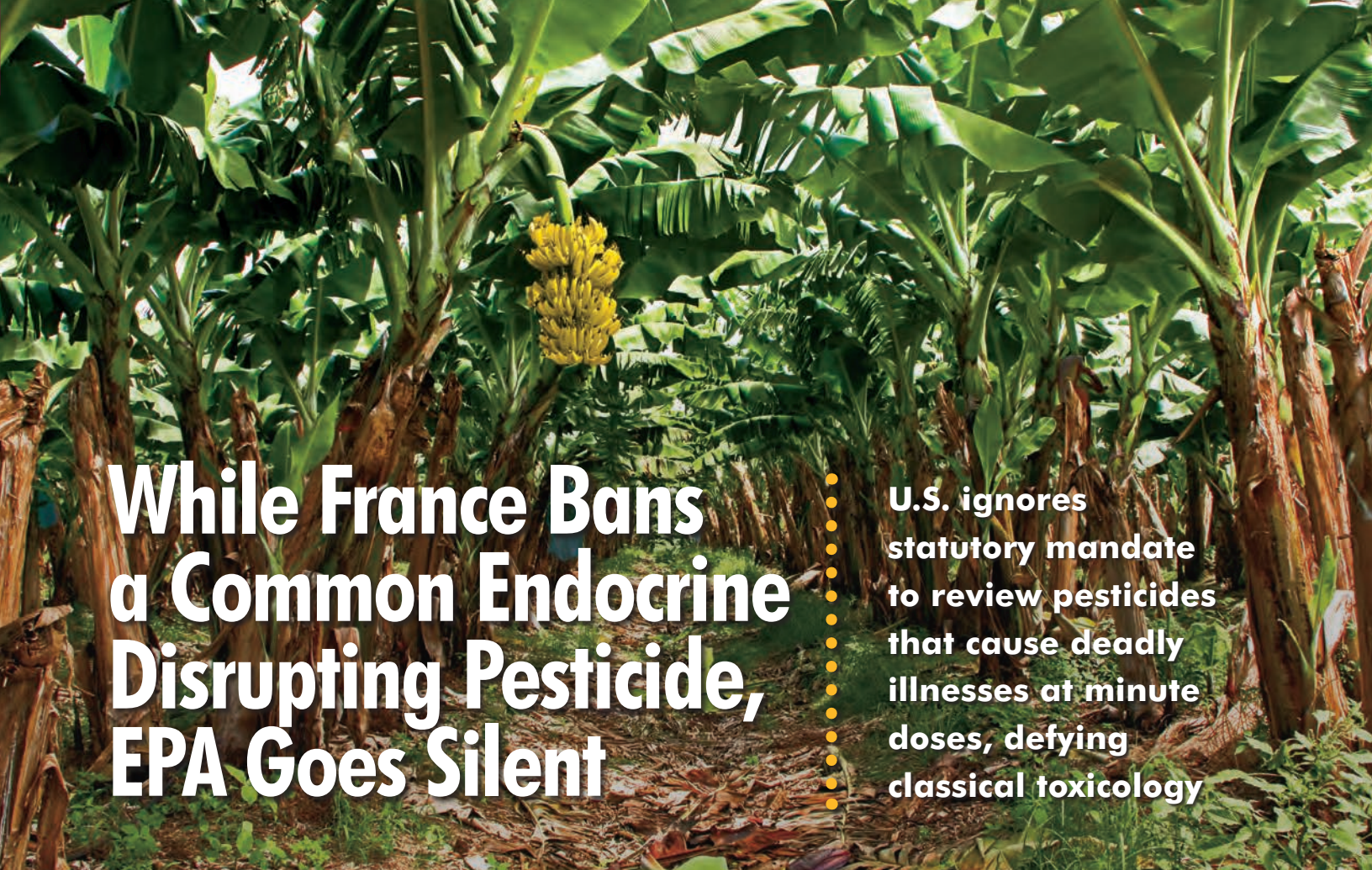
Contamination of drinking water with toxic breakdown products and risks to fish and amphibians have led to a ban on the fungicide chlorothalonil in the European Union (EU). Tens of millions of pounds will continue to be sprayed throughout the U.S. "The [chlorothalonil ban] is based on EFSA's [the European Food Safety Authority's] scientific assessment, which concluded that the approval criteria do not seem to be satisfied for a wide range of reasons," a spokeswoman for the European Commission told *The Guardian*.

EFSA's review of chlorothalonil categorized it as a 1B carcinogen, meaning it "may cause cancer," with the most significant risk found for kidney cancer based on laboratory animal

studies. Further research is needed into many of the metabolites (breakdown substances) created when chlorothalonil degrades. However, regulators determined that enough data was present to conclude that these breakdown substances may be genotoxic, with the potential to damage DNA and lead to cancer.

European regulators also identified a high acute risk to amphibians, and chronic risks to fish from chlorothalonil-contaminated water. However, many European advocates are concerned that the assessment did not adequately characterize the risks that the fungicide poses to wild pollinators. EFSA found low risks to honey and bumblebees at both acute and chronic doses, but advocates say these data should have precipitated follow-up tests on wild pollinators. Matt Shardlow, of the European environmental non-profit Buglife, told *The Guardian*, "[T]he EU process failed to apply the EFSA guidance on assessing risk to bees, so there were no bumblebee safety tests."

Prior research backs up Buglife's concerns. A 2018 study found that pollinators display an attraction to chlorothalonil. Research at Cornell University in 2017 singled out chlorothalonil as a contributing factor to the ongoing decline of pollinators. A 2016 study found that chlorothalonil alters the microbiome of honey bees, and a 2015 study showed reduced bumblebee colony size and health after exposure to the fungicide.



While France Bans a Common Endocrine Disrupting Pesticide, EPA Goes Silent

U.S. ignores statutory mandate to review pesticides that cause deadly illnesses at minute doses, defying classical toxicology

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France's Agency for Food, Environmental and Occupational Health and Safety, ANSES, announced in May a ban on the sale of epoxiconazole, a triazole fungicide commonly used on crops such as bananas, coffee, grains, and beetroot. The ban means that all epoxiconazole products must be removed from commerce within 12 months. The agency indicated that it regards epoxiconazole as a danger to human health, as a likely carcinogen that also affects reproductive function through its endocrine disrupting impacts—risks that are well established. Such threats to human health and to critical ecological and biological systems posed by the use of toxic chemicals are the reasons Beyond Pesticides insists that in the U.S. a far more precautionary approach is needed to the management of pests, whether fungi or insects or plant diseases—there are safer alternative practices and products available.

THE CONCERN ABOUT ENDOCRINE DISRUPTORS

Endocrine disruptors are chemicals that can, even at low exposure levels, disrupt normal hormonal (endocrine) function. Such endocrine disrupting compounds (EDC) include many pesticides, exposures to which have been linked to infertility and other reproductive disorders, diabetes, cardiovascular disease, obesity, and early puberty, as well as attention deficit hyperactivity disorder (ADHD), Parkinson's, Alzheimer's, and childhood and adult cancers. The U.S. Environmental Protection Agency (EPA) and its Endocrine Disruptor Screening

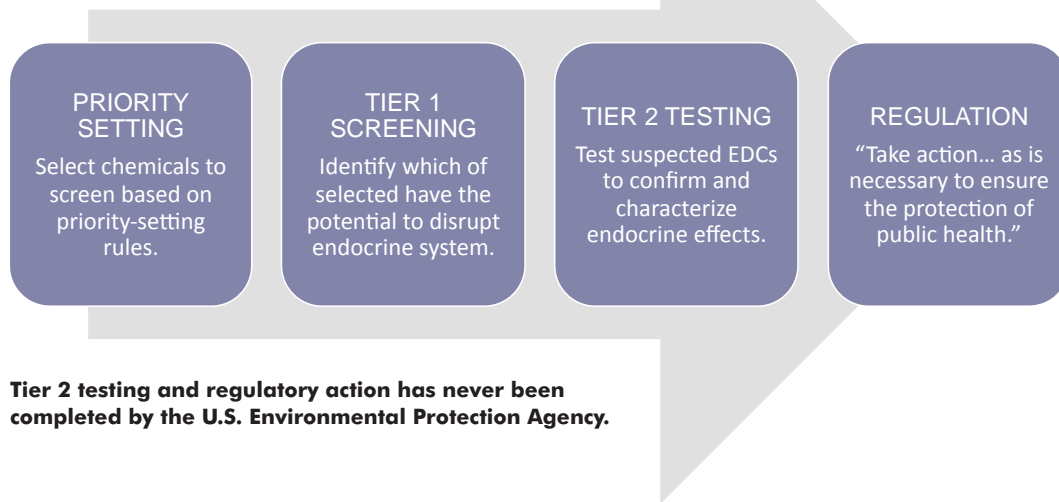
Program (EDSP) began, then virtually stopped, its review and regulation of endocrine disrupting pesticides, despite a mandate in the 1996 *Food Quality Protection Act* (FQPA) to develop a screening program within two years and then begin regulating.

Epoxiconazole is not registered for agricultural use in the U.S., but EPA, which is responsible for registering (i.e., allowing the use of) pesticides, has established a pesticide tolerance for it in the commonly imported crops coffee and bananas. (An EPA tolerance is the maximum amount of a pesticide residue EPA decides may be allowed to remain in or on a food.) In addition to epoxiconazole, there are a host of other triazole fungicides for which EPA has established tolerances (e.g., cyproconazole, fenbuconazole, flutriafol, metconazole, myclobutanil, propiconazole, tebuconazole, and tetraconazole), and many are registered for use in the U.S.

ANSES managing director Caroline Semaille noted that ANSES focused on epoxiconazole because of its ubiquity in French agriculture, but that the agency will examine other pesticide compounds in the context of the European Union guidelines. Ms. Semaille also commented, "A guide published in June 2018 at the European level set scientific criteria to say whether an active substance is an endocrine disruptor. On the basis of the new guide, we can establish and confirm that [epoxiconazole] is an endocrine disruptor."

FIGURE 1

Endocrine Disruptor Screening Program (EDSP) Stages



TRIAZOLE FUNGICIDES KNOWN TO DISRUPT THE ENDOCRINE SYSTEM

The triazoles are part of a class of demethylation inhibitors (DMI). This, of course, is not new to EPA. In fact, a U.S. Geological Survey report, *Toxicity, Sublethal Effects, and Potential Modes of Action of Select Fungicides on Freshwater Fish and Invertebrates*, cited the scientific literature in its report in 2012 (updated 2014) that finds endocrine disrupting effects associated with the DMI class of fungicides. The report states: “Imidazoles, triazoles, and the pyrimidine fungicide fenarimol belong to the cytochrome P450-de-methylase inhibiting (DMI) class of fungicides, but disrupt other CYP450s, such as aromatase (CYP19) in both mammals and fish, indicating endocrine disruptive action is associated with DMI fungicides (Ankley and others, 2005). . . .”¹

WHAT DOES THE LAW REQUIRE?

FQPA mandates that EPA (working with Department of Health and Human Services and the Food and Drug Administration) evaluate pesticides for their endocrine disrupting properties. In the authorities, standards, and tolerance section of the law, FQPA states, “In establishing, modifying, leaving in effect, or revoking a tolerance or exemption for a pesticide chemical residue, the Administrator shall consider, among other relevant factors—such information as the Administrator may require on whether the pesticide chemical may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen or other endocrine effects.”² More broadly, the law calls for EPA’s program to conduct screening of pesticides and “any other substance that may have an effect cumulative to an effect of a pesticide chemical if . . . a substantial population may be exposed to such substance.” If such effects are found, the law states, “[T]he Administrator shall, as appropriate, take action under such statutory authority . . . as is necessary to ensure the protection of public health.”

Despite the FQPA mandate, EPA missed the statutory deadline to develop a screening program by 1998 and complete implementation of a plan by August 1999. In its 1999 progress report, EPA said, “[T]he Endocrine Disruptors Screening and Testing Advisory Committee (EDSTAC) was formed to help us develop a process for determining which chemicals might potentially disrupt the hormone (endocrine) systems of humans and wildlife. EDSTAC reached consensus on recommendations in August 1998 and those recommendations, considered in combination with public comments, are helping EPA develop a final endocrine disruptor effects screening program.”

HOW DOES EPA SCREEN AND TEST CHEMICALS?

The screening and testing protocol established by EPA, with input from EDSTAC, begins with priority setting. Of the more than 87,000 pesticide chemicals that could possibly be screened, EDSP attempts to select subsets for screening based on certain priority-setting rules. Early on in the program’s development, EPA’s EDSTAC recommended a process of priority-setting for selecting chemicals to be screened, “based on *both effect and exposure* data following guidance in NRC [National Research Council/National Academy of Sciences] and EPA risk assessment literature.”³ A 1999 EPA advisory committee report states, “The greatest weight should be given to chemicals for which we have data that indicates actual human or environmental exposure and effects.” Yet, when EPA made its selections for screening, titled List 1 and List 2, only registration status and exposure data were considered as prioritization factors. Lists 1 and 2 were both defined without using any available information on actual endocrine disrupting effects.

The Tier 1 Screening Battery is “designed to detect a substance’s *potential* for causing disruption in one or more of the three hormone systems . . . estrogen, androgen, and thyroid.”

FIGURE 2

Endocrine Disruptor Screening Program (EDSP): From Start to Stalled, 1996–2019

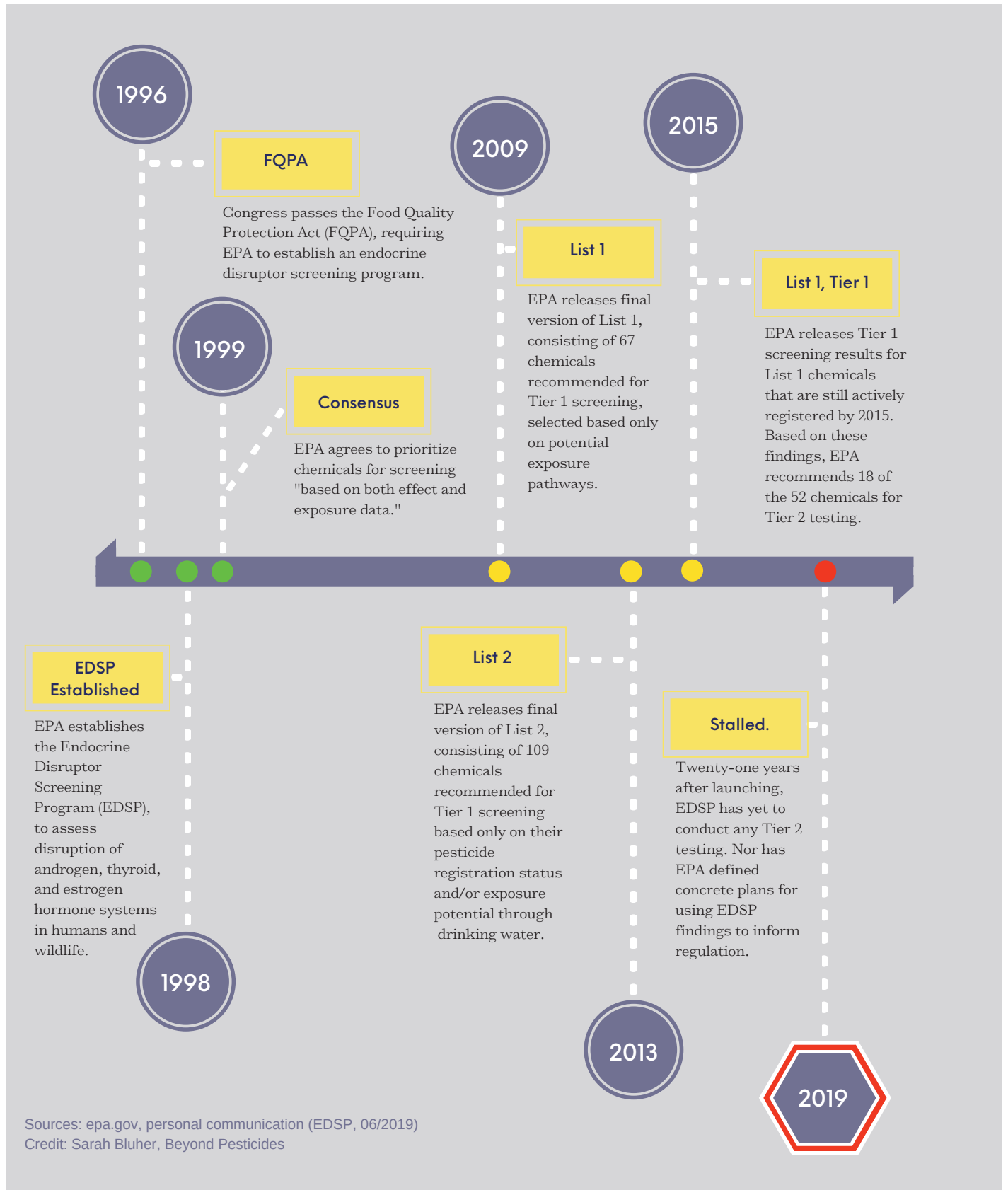
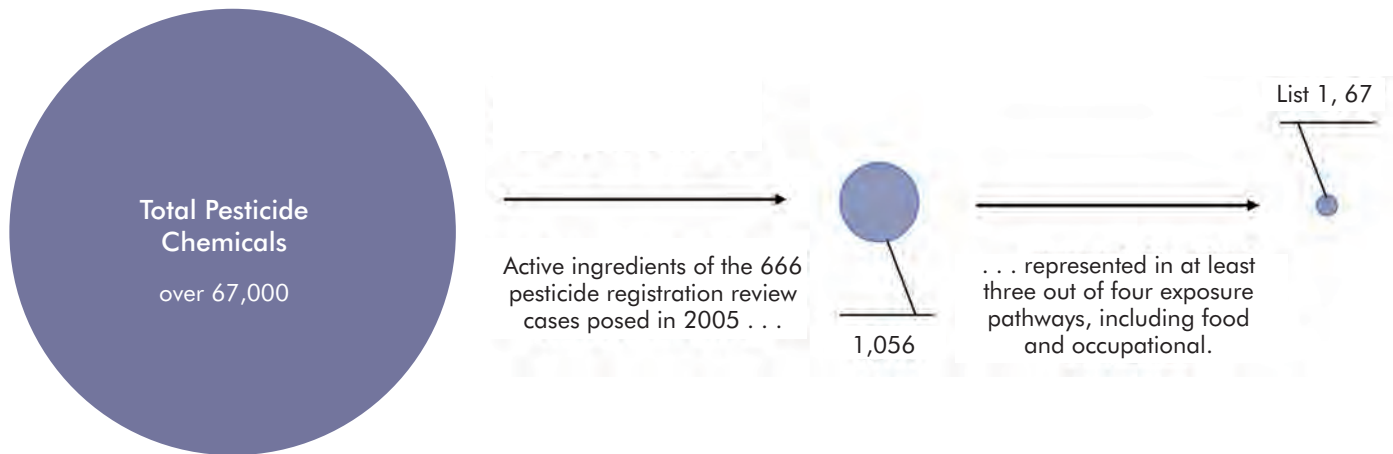


FIGURE 3

How Did EPA Choose the Chemicals to Screen?



As emphasized by EPA, Tier 1 Screening is not sufficient to implicate a chemical as an endocrine disrupting chemical (EDC). In other words, Tier 1 findings do not hold much weight on their own. Rather, they are a tool for defining which chemicals must undergo Tier 2 testing.

Tier 2 testing is intended to confirm and characterize endocrine effects, establishing dose-response relationships and other metrics typically used in conducting EPA risk assessments. EPA holds that only Tier 2, and not Tier 1 testing, can “provide definitive proof of a substance’s ability to interact adversely with these hormone systems in the intact organism.” Therefore, Tier 2 testing is the only stage that can influence regulatory decision making.

WILL THE RESULTS BE USED TO REGULATE?

Since its formation 21 years ago, EDSP has generated two lists of chemicals to screen, conducted Tier 1 screening for the first of those lists, and recommended 18 of the 52 screened chemicals for Tier 2 testing.⁴ As of June, 2019, EDSP has not begun Tier 2 testing—not even the first step, making data call-ins—for any of the 18 List 1 chemicals that screened positive for potential endocrine disrupting effects in 2015. Nor has the program begun to move forward with any screening for List 2 chemicals.⁵ There are no plans as yet to expand on the small subset of chemicals selected for screening in Lists 1 and 2.

When EDSP generated Lists 1 and 2, narrowing down from over 87,000 options to just a few hundred chemicals, only registration status and exposure data were considered as prioritization factors. In other words, EPA eliminated thousands of chemicals from undergoing even the first round of screening, without considering whether or not those chemicals were already shown at the time to cause endocrine disruption. And,

in fact, many of the chemicals excluded from consideration *did* have known or suspected endocrine disrupting effects, as openly acknowledged in EPA’s 2013 public notice on the release of List 2, which offers no reasoning for their exclusion:

“EPA also received comments stating that the Agency should have included some chemicals (e.g., triclosan, alkylphenols and alkylphenol polyethoxylates, bisphenol A, musk fragrances, and pharmaceutical estrogens) with known or suspected endocrine disrupting effects on the second list. When compiling the second EDSP list, EPA focused on priority drinking water contaminants and pesticides previously identified by EPA.”

EPA has yet to establish firm plans for how any of the testing results, if completed, will be used to inform regulatory decisions, including pesticide registration reviews.⁶ The view from 2019 looks not much different from 1998. EPA is sitting on the only process it has built for endocrine disruptor regulation, which is, at best, a weak regulatory tool.

EPA’S ENDOCRINE TESTING IS OUTDATED AS WELL AS INCOMPLETE

In 2009, when EPA announced that it was ready to begin testing active and inert (undisclosed) pesticide product ingredients for potential endocrine disrupting effects, prominent researcher and author Theo Colborn, PhD, assailed EPA’s proposed testing protocols, saying that they were outdated, insensitive, crude, and narrowly limited, and would fail to detect many serious effects on human development.

In 2015, EPA finally released results for its Tier 1 screening of 52 pesticide chemicals (both active and inert ingredients) evaluated under EDSP—with recommended Tier 2 level testing (see box, p. 13), which involves review of endocrine disrupting effects across organisms and on non-endocrine

EPA Starts and Stops

In 1998, following a mandate in the *Food Quality Protection Act (FQPA)* of 1996, EPA established a program to screen and test pesticides and other widespread chemical substances for endocrine disrupting effects. Despite operating for 21 years, the Endocrine Disruptor Screening Program (EDSP), established to carry out the act, has made little progress in reviewing and regulating endocrine disrupting pesticides. As of 2019, the program has stalled entirely.

To ensure timely follow-through, EPA was given a timeline to: develop a peer-reviewed screening and testing plan with public input not later than two years after enactment (August 1998); implement screening and testing not later than three years after enactment (August 1999); and report to Congress on the findings of the screening and recommendations for additional testing and actions not later than four years after enactment (August 2000).⁷

TESTING PLAN

The testing plan was due in 1998, but that was the year that EPA established EDSP, based on recommendations of EDSTAC.

IMPLEMENT SCREENING AND TESTING (WAS DUE 1999)

Tier 1 screening results were reported in 2009 and 2013. EDSTAC recommended that priority setting for selecting chemicals be screened, “based on *both effect and exposure data*,”⁸ and a 1999 EPA advisory panel report stated, “The greatest weight should be given to chemicals for which we have data that indicates actual human or environmental exposure and effects.” However, EPA’s screening selections, titled List 1 (2009) and List 2 (2013), considered only registration status and exposure data as prioritization factors.

RESULTS (WAS DUE 2000)

Since, according to EPA, Tier 1 Screening is not sufficient to implicate a chemical as an endocrine disrupting chemical (EDC), but acts as a tool for defining which chemicals must undergo Tier 2 testing, the second tier testing is the only stage that can influence regulatory decision making. Indeed, it is unclear when or how EPA will move forward with Tier 2 testing, and how, if at all, any Tier 2 findings will be used to inform actual regulation.

Since EPA announced it was ready to begin testing both active and inert (usually the majority of the undisclosed product ingredients that compose the solution, dust, or



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granule) pesticide ingredients for potential endocrine disrupting effects in 2009, the protocols EPA proposed to use have become significantly outdated, having been first recommended in 1998. In the interim, science has progressed such that it offers more sophisticated assumptions than those that informed the EPA test designs. Further, as *Beyond Pesticides* noted in 2009, “Each of EPA’s tests and assays was designed under the surveillance of corporate lawyers who had bottom lines to protect, and assorted toxicologists who were not trained in endocrinology and developmental biology. For over a decade, EPA ignored the vast wealth of information on endocrine disruption from independent academic researchers funded by the U.S. and other governments in Europe and Asia.”

REGULATION

The final stage of the EDSP process is simultaneously the most important and least defined step: regulation. A review of endocrine disruptor screening and regulation worldwide made the following criticism of the EPA’s EDSP in 2011,⁹ which still holds today:

“One of the greatest challenges of the EDSP is the current lack of clear decision strategies and processes, or in other words: what happens if a chemical is flagged as a potential EDC during Tier 1 screening? While in theory flagging a chemical during Tier 1 would trigger confirmatory Tier 2 testing, it is unclear how and when this will happen. . . . Similarly, it is unclear what the decision process for removing or limiting the use of chemicals that tested positive will be . . . there is still a great deal of uncertainty and lack of clear policies and available tools that would allow moving a chemical smoothly through the complete EDSP process.”

systems.) In 2015, *Beyond Pesticides* summarized the EPA's performance on evaluating endocrine disrupting chemicals and protecting the public from them: "Delays and criticisms from scientists have highlighted inadequacies of the overall program. After FQPA set a 1999 deadline for EPA to develop a battery of assays with which pesticide manufacturers were required to screen their products as possible endocrine disruptors, EPA repeatedly pushed back the deadline for over a decade. Moreover, critics of EDSP have said that EPA's testing protocol is outdated, failing to keep pace with the science." Adding to the critique, in 2017 *Beyond Pesticides* covered the ongoing inadequacy of EPA's progress on EDCs, noting that "inadequate federal testing, disproportionate industry influence, and subverted regulatory oversight threaten decades of progress on protecting people from hormone disrupting chemicals."

ENDOCRINE DISRUPTION AND RISK ASSESSMENT

A persistent critique of EPA's toxicological assumptions has to do with the "dose makes the poison" concept that underlies conventional toxicology. In fact, researchers have discovered that this concept—that the more exposure, the more extreme the impacts—is not consistently the case across exposures to chemical compounds such as pesticides. Additionally, even very low-level exposures (aka "doses") can, in some instances, cause more extreme health impacts. In this context, it is not dose as much as critical windows of vulnerability or timing of exposure that is important. As long as EPA is tied to the Tier 2 goal of establishing dose-response relationships and other metrics typically used in conducting EPA risk assessments, critics say it is unlikely to arrive at conclusions that are both scientifically supportable and useful for regulation. As stated by Jason M. Vogel, PhD, in 2005,¹⁰ "The EDSP policy design represents revision at the margins of U.S. chemical regulatory policy, not a radical revision. EDSP employs the same basic strategy used to regulate carcinogenic pesticides or toxic

industrial chemicals—scientifically proving harm prior to regulating a chemical. Two important aspects of this strategy include an epistemological assumption that science has the capacity to 'prove' harm under the relevant scientific and legal standards, and an ethical position that prioritizes profit over human health by placing the burden of proof on public and environmental health advocates."

CONCLUSION

Clearly, Europe is moving more expeditiously on the matter of pesticide hazards than is the U.S. EPA needs to expedite the protection of human and ecological health from the threats of toxic pesticides, including the triazoles and other compounds, which are implicated in multiple adverse effect outcomes. *For more information on the effects of pesticides on human health, including endocrine disruption, see Beyond Pesticides' Pesticide Induced Diseases Database.*

Contributors to this article include Debra Simes, Terry Shistar, PhD, and Sarah Blucher.

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Glyphosate Roundup

VICTIMS-3,
MONSANTO/BAYER-0



Two billion and multi-million dollar jury verdicts for health damages force shift in market, while EPA ignores scientific findings and ban in Europe

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JURIES FIND FOR VICTIMS

In May, a California jury awarded plaintiffs in the third damages lawsuit on the weed killer Roundup over \$2 billion in punitive and compensatory damages. The jury found that Monsanto “engaged in conduct with malice, oppression or fraud committed by one or more officers, directors or managing agents of Monsanto.”

Plaintiffs Alva and Alberta Pilliod, a couple in their seventies, used Roundup, with the active ingredient glyphosate, since the 1970s to maintain their yard around their home and other properties that they owned. The couple did not wear protective gear when using Roundup because Monsanto marketed the product as “safe.” Mrs. Pilliod was diagnosed with non-Hodgkin lymphoma (NHL) in 2011; Mr. Pilliod’s diagnosis followed in 2015.

The *Pilliod v. Monsanto* jury came to its decision based on evidence, not only of the herbicide’s carcinogenicity, but also of Monsanto’s role in suppressing and discrediting independent findings regarding Roundup toxicity. In an interview with U.S. Right to Know’s Carey Gillam, co-lead trial counsel Michael Miller said, “Unlike the first two Monsanto trials, where the judges severely limited the amount of plaintiffs’ evidence, we were finally allowed to show a jury the mountain of evidence showing Monsanto’s manipulation of science, the media and regulatory agencies to forward their own agenda despite Roundup’s severe harm to the animal kingdom and human-kind.”

That glyphosate-based herbicides cause cancer is by now a matter of scientific consensus. In 2015, the World Health Organization’s International Agency for Research on Cancer

The Pilliod v. Monsanto jury came to its [\$2 billion] decision based on evidence, not only of the herbicide’s carcinogenicity, but also of Monsanto’s role in suppressing and discrediting independent findings regarding Roundup toxicity.

(IARC) found glyphosate to be a probable human carcinogen. In response to resistance from the European Food Safety Authority, 94 expert scientists published an article in support of IARC’s methodologies and findings.¹ Since 2015, several more publications have added significant weight to the body of evidence supporting glyphosate’s carcinogenicity. A 2018 meta-analysis of studies on glyphosate suggested “a compelling link between exposures to GBH [glyphosate-based herbicides] and increased risk of NHL [non-Hodgkin lymphoma].” A 2019 University of Washington study found that glyphosate exposure increases the risk of NHL by as much as 41%. As of July 7, 2017, glyphosate is listed as a cancer-causing chemical under California’s Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). This requires that cancer warning labels be placed on end-use glyphosate products in California.

The Pilliod trial adds to the growing list of major wins for plaintiffs who attribute their suffering from cancer to Monsanto’s

Collusion Between Monsanto and EPA

More so than previous trials, the Pilliod trial highlighted evidence of collusion between Monsanto and top EPA officials to defend against the onslaught of Roundup cancer trials. Jurors were presented with communications uncovered through a 2017 Freedom of Information Act (FOIA) request, in which EPA officials responded to requests from Monsanto to effect a delay in the 2015 Agency for Toxic Substances and Disease Registry review of glyphosate. The Pilliods' attorneys also presented new documents, including a report attached to a July 2018 email between the strategic intelligence firm Hayklut and Monsanto. As covered by U.S. Right to Know, the report includes the reassurance, "A domestic policy adviser at the White House said, for instance: 'We have Monsanto's back on pesticides regulation. We are prepared to go toe-to-toe on any disputes they may have with, for example, the EU. Monsanto need not fear any additional regulation from this administration.'"

Accordingly, in spite of mounting consensus on Roundup's carcinogenicity, EPA released a proposed interim decision for glyphosate's registration review in May, stating that glyphosate is "not likely to be carcinogenic to humans." In a statement expressing its intent to appeal the case, Bayer referenced that the jury verdict "conflicts directly with the U.S. Environmental Protection Agency's interim registration review decision released just last month."

"malice, oppression or fraud." In the summer of 2018, California groundskeeper Dewayne "Lee" Johnson won a \$289 million jury verdict against Monsanto for his development of NHL after consistent exposure to Roundup. The jury awarded him \$39 million in compensatory damages, and \$250 million in punitive damages, finding that Monsanto acted with "malice or oppression." That amount was later amended by the judge to a total of \$78 million. In the second federal court case, again in California, the jury found unanimously that Edwin Hardeman's development of NHL was substantially caused by Roundup and awarded him \$80 million.

Pilliod v. Monsanto is the third Roundup case to proceed to trial. Bayer/Monsanto still faces more than 13,000 similar pending lawsuits nationwide, by some counts. The fact that multiple federal cases have found that Roundup caused plaintiffs' cancer is a testament to the weight of independent scientific evidence supporting the link between glyphosate-based herbicides and NHL. EPA's failure to acknowledge that weight of evidence, and its active role in protecting Monsanto's financial interests, are viewed by advocates as a threat to national public health.



Dewayne "Lee" Johnson, former groundskeeper who developed non-Hodgkin lymphoma after using glyphosate/Roundup, speaking to officials and community people in Hawai'i.

NEW SCIENCE

Meanwhile, the science on the adverse effects of glyphosate keeps coming. What follows are recent findings:

Cancer. Despite attempts by current and former EPA top officials to kill their report,² the Agency for Toxic Substances and Disease Registry (ATSDR), an agency of the U.S. Department of Health and Human Services, released its first draft of the Toxicological Profile for Glyphosate, including top-line findings affirming glyphosate's cancer-causing properties.³

Fatty Liver Disease. Researchers at the University of California (UC) San Diego found that glyphosate-based herbicides may be contributing to the growing worldwide epidemic of non-alcoholic fatty liver disease (NAFLD), a condition that causes swelling of the liver, and can eventually lead to cirrhosis, cancer, or liver failure.⁴

Transgenerational Effects. Researchers at Washington State University have identified, in a study that exposed pregnant rats to glyphosate, significant disease in subsequent generations.⁵ The rats were exposed, from day 8 through day 14 of gestation, to half the threshold no observable adverse effect level (NOAEL) of glyphosate. Although this study found negligible impacts on the pregnant rats themselves or on their first-generation offspring, dramatic increases in the incidence of disease were found in the two subsequent generations, including reproductive (prostate and ovarian) and kidney diseases, obesity, and birth anomalies. Such transgenerational impacts are "molecular factors and processes around DNA that regulate genome activity (e.g., gene expression) independent of DNA sequence. . . ."⁶ Epigenetic changes result in genes being turned on and off, often in response to environmental factors, such as exposure to toxic chemical compounds. In this investigation, researchers saw a 30% incidence of prostate disease in third-generation (3G) males, which is three times the rate found among the study's controls. Among 3G females, there was a 40% incidence of renal disease, representing a fourfold increase compared with controls. More than one-third of 2G females had failed pregnancies, and 40% of 3G males and females were obese.

This study is the first to assess the potential transgenerational impacts of glyphosate in mammals. Its results point to an

emerging frontier in assessing the risks of glyphosate and other toxic chemicals, and add to the urgent and growing demand that the use of this toxic and pervasive pesticide be halted.

PESTICIDE DISTRIBUTOR AND INSURERS BACK AWAY FROM GLYPHOSATE

With the liability of glyphosate rising astronomically, those companies selling or using the weed killer are thinking seriously about their financial exposure. Harrell's, a company that sells chemicals primarily to golf courses and the horticulture-nursery, turf, and landscape sectors, announced in March that it stopped selling products containing glyphosate as of March 1, 2019 because neither its current insurance company nor others the company consulted would underwrite coverage for the company for any glyphosate-related claims. The insurers' decision also recognizes the successful and pending glyphosate-based suits against manufacturers, sellers, and users. According to Harrell's CEO, "During our annual insurance renewal last month, we were surprised to learn that our insurance company was no longer willing to provide coverage for claims related to glyphosate due to the recent high-profile lawsuit and the many thousands of lawsuits since. We ... could not buy adequate coverage for the risk we would be incurring. So, we ... no longer offer products containing glyphosate."

Weber Gallagher, a law firm that serves as defense counsel for many corporations and industries, commented very shortly

after the verdict in *Dewayne Johnson v. Monsanto*, in an article on its website titled, "Big Monsanto Loss Signals Glyphosate Litigation Headache for Policyholders, Insurers and Reinsurers." It concluded, "Without a doubt, like all other mass tort litigation (asbestos, environmental, toxic tort), the issues raised by current and inevitable future glyphosate lawsuits present overwhelming exposures for policyholders, insurers and reinsurers on such key issues such as trigger of coverage, number of occurrences, allocation of loss and the insurability of punitive damages. One only has to ask regarding who is going to pay for last month's Monsanto verdict to understand the enormity of the issue." Despite inaction by federal regulators, the future of glyphosate/Roundup is certainly uncertain as juries objectively consider the scientific facts linking exposure to cancer and other adverse health effects.

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BOX 2

Local Action on Glyphosate

In addition to the jury verdicts based on an evaluation of the science, medical testimony, and a review of deficient EPA regulation, actions to curtail glyphosate are taking place across the county and around the globe.

Community Action

Twenty communities have banned glyphosate by ordinance or resolution since the first Roundup cancer trial verdict. Beyond Pesticides' Map of U.S. Pesticide Reform Policies identifies over 170 communities that have reined in toxic pesticides for lawn and landscape use to some degree. Many have taken a comprehensive approach by seeking to transition away from all toxic pesticide use, including 32 municipalities that have adopted organic practices on public land and/or banned toxic pesticides on all property within their jurisdiction.

University Action

University of California (UC) President Janet Napolitano announced a temporary ban, which began on June 1, on the use of glyphosate on all of UC's 10 campuses. The ban will affect the more than 200,000 students in the UC system, and countless other staff, faculty, and visitors

to the campuses. In announcing the ban, the university cited "concerns about possible human health and ecological hazards, as well as potential legal and reputational risks associated with this category of herbicides." (There are exceptions to the temporary suspension, such as uses for "agricultural operations, fuel-loaded management programs to reduce wildfire risk, native habitat preservation or restoration activities and research that requires glyphosate-based herbicides.")

The suspension of glyphosate use at UC comes in large part as a result of the campaign Herbicide-Free UC—which began as Herbicide-Free Cal, founded by student-athletes Mackenzie Feldman and Bridget Gustafson. The students became active on pesticide issues when they discovered that herbicides were in use around the volleyball court on which they and other athletes spent countless hours. Begun when the women were juniors at UC Berkeley, Herbicide-Free UC pushed for a pilot chemical-free weed management program on the campus. Beyond Pesticides is working with UC Berkeley grounds operations to transition two central glades on campus to organic land management.



Organic

Systems

The Path Forward

Public health threats of foodborne diseases are curtailed through soil health and balanced ecological systems

While some have assumed that organic produce is more likely to be contaminated with pathogens, recent research demonstrates the opposite is true. According to a study evaluating the benefit of soil organisms, organic farming promotes natural resistance to common foodborne human pathogens. By protecting valuable species of dung beetles and soil bacteria, organic farming systems naturally act to clean up and decompose potentially pathogen-bearing animal feces. These natural systems suppress pathogens on organic farms, but chemical-intensive farms are left with higher levels of fecal residues and are therefore significantly more likely to yield produce carrying such foodborne pathogens as *E. coli*. The authors of a new study emphasize that curbing the spread of common foodborne pathogens could save thousands of lives and prevent millions of illnesses each year.

ECOSYSTEM SERVICES OF ORGANIC

The study, "Organic farming promotes biotic resistance to foodborne human pathogens," published in the *Journal of Applied Ecology*,¹ compares dung beetle populations, soil bacteria diversity, and feces removal rates on 70 organic and chemical-intensive broccoli farm fields across the west coast of the U.S. In addition to studying field conditions, the authors conducted additional microcosm studies to directly test the effects of dung beetles and soil microbes on the suppression of introduced *E. coli*.

Results from field analyses show that organic management practices lead to greater biodiversity among dung beetles and soil microbes, which translate to higher rates of feces removal. Microcosm results confirm that by removing fecal matter, the beetles and microbes retained by organic management reduce potential *E. coli* contamination. These new findings add to the list of ecosystem services unique to organic farms, further bolstering the case for organic as not only an ecological but an economical solution to global food production.

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In the context of recently reviewed insect declines worldwide (featured in the Spring 2019 issue of *Pesticides and You*) and general biodiversity declines (as reported elsewhere in this issue), this study also serves as a warning of yet another key ecosystem service that will certainly be lost unless a major agricultural transformation to organic systems is undertaken. Dung beetles, whose actions in soils not only protect against pathogens, but also unlock critical nutrients, are in decline. The impacts of dung beetles on soil fertility are vital to the sustainability of farms and pastures used to maintain livestock. By burying and processing feces on cattle farms, dung beetles increase soil nitrogen by 80%. By increasing soil organic matter, dung beetles simultaneously increase water infiltration, thus stabilizing farms and heavily grazed areas against erosion, flooding, and drought.

APPRECIATING DUNG BEETLES

Findings from this study highlight the need for dung beetle diversity in addition to abundance, because some dung beetles bury feces more effectively than others. Notably, researchers find that the commonly introduced species *O. nuchicornis*, which tends to dominate over other species and reduce overall diversity, is less effective at burying feces, with consequences for both *E. coli* contamination and soil fertility. Similarly,

BOX 1

Getting Off the Treadmill

Ignoring nature has become exceedingly perilous. Insects and microbes that act to control crop pests and fertilize the soil eliminate the need for pesticide and chemical fertilizer use. Reliance on chemical controls creates a vicious treadmill: pesticide use kills natural agents of pest control, thus creating a demand for more pesticide use, which kills more of the beneficial organisms, and so on.

previous work attests to the importance of soil microbial diversity for maintaining ecosystem services. The key to healthy produce and fertile soils, across the board, is diversity.

INSECTS AND DIVERSITY IN DECLINE

Due to agrochemical use, this precious diversity is in decline. Monitoring in Europe, according to the 2019 review of insect declines,² shows the greatest terrestrial loss of insect biodiversity on record to date: more than 60% of documented dung beetle species are in decline. Soil microbial diversity, too, is threatened by continued application of pesticides in industrialized agriculture. Soil fumigants, which are highly toxic gases, are used on a wide range of high-value crops to control nematodes, fungi, bacteria, insects, and weeds. They wipe out entire soil communities, thus necessitating the use of other chemicals to provide the fertility and pest control services that soil organisms would otherwise provide. In addition to fumigating soil, which intentionally kills all living organisms in the soil, other chemical-intensive practices also threaten soil life. Glyphosate, the most widely used herbicide, is also an antibiotic. Glyphosate-tolerant plants release glyphosate into the soil, where it has a continued adverse impact on soil microbial diversity.

REGENERATIVE AGRICULTURE

“Regenerative” agriculture is a term with a range of interpretations, but the key element is improving soil health through carbon sequestration. Robert Rodale, one of the early proponents of organic agriculture, coined the term to characterize a process that moves beyond sustainable maintenance and into improvement of resources. This methodology is gaining traction in the farming world because it is economically beneficial to farmers and promotes environmental remediation. A 2018 study, “Regenerative agriculture: merging farming and natural resource conservation profitably,”³ shows that ecologically-based farming systems have fewer pests and generate higher profits than their chemical-intensive counterparts.

Regeneration International offers the following definition: “‘Regenerative Agriculture’ describes farming and grazing practices that, among other benefits, reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity—resulting in both carbon drawdown and improving the water cycle.” Agriculture contributes, by some estimates, up to 30% of global greenhouse gas emissions. On the other hand, soil is an enormous potential area for carbon storage (a “sink”) and benefits from the additional carbon structure. Healthy, carbon-rich soil stores water and erodes less, making fields more tolerant to disruptive weather, such as heavy rain or drought.

Some no-till advocates, while focused on improving soil health and reducing inputs, find it difficult to move away from synthetics entirely. According to no-till advocate and Arkansas



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BOX 2

Greenwashing or Real Solutions

General Mills announces a “regenerative” approach that includes some continued toxic chemical dependency

Corporate food giant General Mills has thrown some weight behind “regenerative” agriculture, committing to converting one million acres of farmland to regenerative practices by 2030. Some—but not all—of the initiative involves organic land management, and the company is silent in this initiative on the use of genetically engineered plants and related technologies.

General Mills lays out three foci within its definition of regenerative agriculture:

1. **Healthy Soil:** Carbon rich, biologically active soil plays an essential role in cleaning and storing water, supporting biodiversity and regulating the climate.
2. **Above-Ground Biodiversity:** Diversity in crop varieties, grazing animals, wildlife and pollinators supports resilient ecosystems that can better withstand disease, pests and climate fluctuations.
3. **Farmer Economic Resilience:** Regenerative agriculture practices can strengthen whole farm profitability and resilience over time.

“Practitioners who have done this the longest point to the fact that, in extreme years, their farms will do better than those who do not,” says Jerry Lynch, General Mills’ chief sustainability officer. “After some transition time, depending on their location and cropping system, farmers are saving a lot of money because they’re using fewer inputs.”

General Mills is making significant investments, including grand-scale land conversions and working with training partners. They have donated \$650,000 to the nonprofit organization Kiss the Ground for training and coaching. Part of the company’s million-acre effort includes converting 34,000 acres in South Dakota from conventional chemical-intensive farmland management to certified organic through a partnership with Midwestern BioAg.

The heavy involvement of General Mills might raise some eyebrows in a field generally dominated by small, even anti-establishment farmers and advocates. (That skepticism might be supported by the fact that Beyond Pesticides last year negotiated a legal settlement against General Mills regarding their misleading “100% Natural Oats” label on Nature Valley Granola Bars.)

Addressing cynicism of investment by their corporate entity in organic, Carla Vernon, president of General Mills’ natural and organic business stated, “We feared the skepticism of General Mills would overshadow the good work of our natural and organic brands, but Big Food must be at the table if we are going to make a difference at scale.”⁶

Like all food producers, General Mills has a bottom line that will be affected indiscriminately by climate change and pollinator decline. Mr. Lynch told *Successful Farming*, “The trend is increased demand, and coupled with a dwindling natural resource supply, and the pressure facing farming communities, we are concerned with that.”

farmer Adam Chappel, “You can’t quit [synthetic fertilizer and herbicides] cold-turkey,” but he notes that after a few years in the practice, “I don’t need seed treatments for my cotton anymore. I’ve taken the insecticide off my soybeans. I’m working toward getting rid of fungicides.... I’m hoping that eventually my soil will be healthy enough that I can get rid of all of it all together.”⁴ However, many programs that are dependent even on reduced pesticide and synthetic fertilizer use maintain a dependency on those toxic inputs because the soil biology is not fully supported by practices and amendments that grow the biomass and ultimately nutrient cycling.⁵

REGENERATIVE ORGANIC = REAL ORGANIC?

There is crossover between regenerative and other agricultural movements, such as organic or no-till. In the face of erosion of the organic label by hydroponics and big agriculture, the Real Organic Project (ROP)—a coalition of farmers and advocates—will bolster the organic label with an add-on label, reiterating the importance of soil in organic. “Organic Farming was defined back in its infancy as a farming method that is centered on maintaining fertile and biologically healthy soil,” states the organization’s website.

In 2017, the Rodale Institute introduced a label for regenerative agriculture food using the USDA certified organic as a baseline requirement. With another add-on to the organic label, Regenerative Organic Certification (ROC) involves three pillars of soil health, animal welfare, and social fairness. The group’s definition of soil health includes no synthetic inputs (i.e., pesticides or fertilizers).



© Linley Dixon/Real Organic Project

Current NOSB member and Real Organic Project farmer, Emily Oakley, harvests head lettuce at her farm, Three Springs Farm in Oklahoma. The cover crop rotations provide the large majority of the soil fertility required for the intensive vegetable production the following year.

REGENERATIVE ORGANIC—FOR THE FUTURE

Whatever the motive, industry involvement is significant in a growing organic regenerative movement. Robert Rodale remarked in a 1989 interview, “I don’t think the average person aspires to live in a sustained environment, they want to live in something that’s expanding and getting better, so I think the idea of regeneration is more appealing.”⁷

Retaining and capturing carbon in the soil is both good for soil health and is a means of addressing the climate crisis, which is fueled by rising levels of atmospheric carbon. The choice for agriculture is between a full-scale adoption of practices that eliminate fossil fuel-based pesticides and fertilizers to protect and enhance nature and its ecosystem services, and adopting some measures that offer a partial solution, but do not meet the looming climate and biological diversity crises. While organic, as embraced by the *Organic Foods Production Act*, defines and sets a certification framework for enforcing whole systems approaches that cycle nutrients naturally in the soil and respects biodiversity, other approaches fall short of this transformative strategy. As a result, terms, such as “regenerative,” “ecological,” and “sustainable,” are used without definition and a public process for ensuring methods that meet the rhetoric and the urgent need for an expedited response to the environmental and public health crises on the horizon. Instead, “organic” must be defined in a way that embraces regenerative, ecological, and sustainable practices.



Devon cattle out on pasture at Luna Bleu Farm, a diversified Real Organic Project farm in South Royalton, Vermont. Devon cattle are efficient grazers and produce high-quality beef on a grass-based diet.

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UN DOCUMENTS ACCELERATING BIODIVERSITY LOSS THREATENING

ALL LIFE Ecosystem protections and transformative change urgently needed

DEBRA SIMES

Biodiversity, upon which human life depends, is being lost at an alarming rate. This loss, and the drivers accelerating it, have been documented by hundreds of recent studies. The collective significance of these studies has been examined in reviews, including “Worldwide decline of the entomofauna: A review of its drivers,” which was featured in the Spring 2019 issue of *Pesticides and You*.

NEW UNITED NATIONS ASSESSMENT

A new assessment from the United Nations Decade on Biodiversity project brings together three years of work by 145 experts from 50 countries, informed by 15,000 scientific studies and other resources, including indigenous and local knowledge, to underscore the speed and depth of biodiversity loss—and its causes and effects. The 1,500-page report by IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services), the IPBES Global Assessment Summary for Policymakers, is the most comprehensive look to date at the biodiversity crisis and its implications for human civilization. A summary of the report’s findings, approved by representatives from the U.S. and other member countries,* was released in Paris in May, and the complete report is expected later in 2019.

IPBES is an intergovernmental body of 132 member states, established by the United Nations in 2012, that assesses the state of biodiversity and of the ecosystem services such diversity provides to societies. The group also reports to policymakers on those assessments, and on the dynamics—causes and impacts—between human activity and the state of biodiversity and ecosystem services.

NATURE IS DETERIORATING

The IPBES report finds that nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide. The report finds, “Since 1970, trends in agricultural production, fish harvest, bioenergy production and harvest of materials have increased, but 14 of the 18 categories of contributions of nature that were assessed, mostly regulating and non-material contributions, have declined.” Among the contributions that have declined are soil organic carbon and pollinator diversity. Land degradation and pollinator loss put agricultural pro-

duction at risk. Loss of coastal habitats and coral reefs result in increased risk from floods and hurricanes. Among the summary’s alarming conclusions are that, across most of the globe’s major habitats, the plenitude of plants and animals has dropped by 20% or more during the past century. Around one million species are threatened with extinction.

DRIVERS OF CHANGE HAVE ACCELERATED

The report finds that direct and indirect drivers of change have accelerated during the past 50 years. Human activities—including agriculture, land conversion through logging and subsequent deforestation, extraction of minerals and fossil fuels, overfishing, poaching, and pollution of all sorts—are changing the face and dynamics of the natural world at a rate “unprecedented in human history.” Pesticides are

BOX 1

Comments on the UN Report

Project co-chair Eduardo Brondizio, PhD of Indiana University remarked at a press conference on the release, “We have reconfigured dramatically life on the planet.”

Thomas Lovejoy, PhD, George Mason University Professor of Biology, Senior Fellow at the United Nations Foundation, former assistant secretary for environmental and external affairs for the Smithsonian Institution—who is sometimes called the ‘godfather of biodiversity’ for his research efforts—commented, “Humanity unwittingly is attempting to throttle the living planet and humanity’s own future.... The biological diversity of this planet has been really hammered, and this is really our last chance to address all of that.”

Sir Robert Watson, PhD, a British, and former NASA scientist who headed the report, noted that, “The findings are not just about saving plants and animals, but about preserving a world that’s becoming harder for humans to live in. ‘We are indeed threatening the potential food security, water security, human health and social fabric’ of humanity, Dr. Watson said, adding, ‘Business as usual is a disaster.’”

* https://www.ipbes.net/sites/default/files/downloads/spm_unedited_advance_for_posting_htn.pdf.

one of the contributors to loss of biodiversity. The report finds, “Species loss is accelerating to a rate tens or hundreds of times faster than in the past,” with insufficient habitat for long-term survival.

IPBES asserts that this decline in biodiversity threatens society’s ability to meet people’s basic needs, and that current patterns of production and consumption are unsustainable. The report notes, “Harmful economic incentives and policies associated with unsustainable practices of fisheries, aquaculture, agriculture (including fertilizer and pesticide use), livestock, forestry, mining and energy (including fossil fuels and biofuels) are often associated with land/sea-use change and overexploitation of natural resources, as well as inefficient production and waste management.” The report endorses the transition away from pesticide-laden agricultural practices and toward sustainable agriculture.

Exacerbating this biodiversity loss is climate change, which is heating the planet through human activities that dump greenhouse gases (GHGs), notably carbon dioxide and methane, into the atmosphere. The report says, “The rate of global change in nature during the past 50 years is unprecedented in human history.” It identifies climate change as one of the most impactful drivers, after changes in land and sea use and direct exploitation of organisms.

The GHG load in the atmosphere, when combined with the other drivers of human damage to the environment, is helping drive a rapidly increasing number of species toward extinction—and sooner, rather than later. “Human actions threaten more species with global extinction now than ever before,” the report concludes, estimating that “around one million species already face extinction, many within decades, unless action is taken.” The report further projects that, absent major conservation efforts across the planet, biodiversity loss—particularly in the tropics—will accelerate at least through 2050.

SUSTAINABILITY GOALS CANNOT BE ACHIEVED WITHOUT TRANSFORMATIVE CHANGE

The IPBES report finds, “Goals for conserving and sustainably using nature and achieving sustainability cannot be met by current trajectories, and goals for 2030 and beyond may only be achieved through transformative changes across economic, social, political and technological factors.” While pulling no punches about the gravity of the situation, the IPBES report points to the possibility for arresting and redirecting the current entropy: “The negative trends in biodiversity and ecosystem functions are projected to continue or worsen in many future scenarios in response to indirect drivers such as rapid human population growth, unsustainable production and consumption, and associated technological development. In contrast, scenarios and pathways that explore the effects of a low-to-moderate population growth, and transformative changes in production and consumption of energy, food,

feed, fibre, and water, sustainable use, equitable sharing of the benefits arising from use and nature-friendly climate adaptation and mitigation, will better support the achievement of future societal and environmental objectives.”

CONSERVATION AND SOCIETAL GOALS CAN BE MET THROUGH TRANSFORMATIVE CHANGE

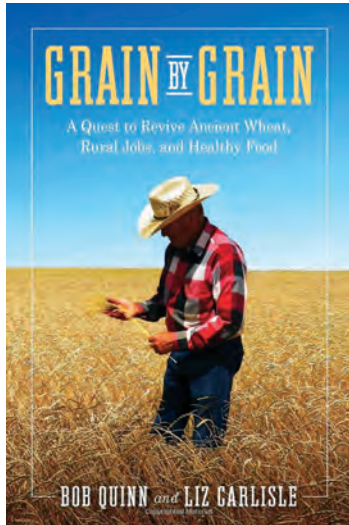
The report says, “Nature can be conserved, restored and used sustainably while simultaneously meeting other global societal goals through urgent and concerted efforts fostering transformative change.” It directs policymakers toward pathways that can generate “the transformative change needed to reverse these alarming trends.” Such paths include further and more resolute international cooperation; reversal of perverse—i.e., crisis-exacerbating—incentive structures; use of more holistic decision making; and strengthened implementation of environmental laws and policies. It also sets out a number of nature-based solutions that address some of the identified challenges:

- reducing deforestation, restoring forests, wetlands, and other ecosystems, and agricultural practices that build soil organic matter could together contribute more than a third of the total efforts needed by 2030 to keep global warming below two degrees;
- better use of biodiversity in agriculture (such as pollinators, natural enemies of pests and soil biodiversity) could increase yields while reducing the use of harmful chemicals;
- protecting coral reefs and mangroves protects coastal areas from extreme weather events

The released summary provides a comprehensive conclusion:

Societal goals—including those for food, water, energy, health and the achievement of human well-being for all, mitigating and adapting to climate change and conserving and sustainably using nature—can be achieved in sustainable pathways through the rapid and improved deployment of existing policy instruments and new initiatives that more effectively enlist individual and collective action for transformative change. Since current structures often inhibit sustainable development and actually represent the indirect drivers of biodiversity loss, such fundamental, structural change is called for. By its very nature, transformative change can expect opposition from those with interests vested in the status quo, but such opposition can be overcome for the broader public good. If obstacles are overcome, commitment to mutually supportive international goals and targets, supporting actions by indigenous peoples and local communities at the local level, new frameworks for private sector investment and innovation, inclusive and adaptive governance approaches and arrangements, multi-sectoral planning and strategic policy mixes can help to transform the public and private sectors to achieve sustainability at the local, national and global levels.

Grain by Grain: One Farmer's Challenge to Industrial Agriculture and Path to an Organic Future



Grain by Grain: A Quest to Revive Ancient Wheat, Rural Jobs, and Healthy Food, Bob Quinn and Liz Carlisle, Washington: Island Press, 2019.

Cheap food. Big ag. Big food. Rural job loss and poverty. Soil degradation. Pollution. Health decline. Climate crisis. As a farmer, Bob Quinn has shown that there are solutions. He grew up on a 2,400-acre family farm in Big Sandy, Montana, has taken on these intractable problems related to chemical-intensive production

of what he calls “cheap commodity foods.” The book reads like a memoir with well-researched and cited facts to bolster his experiences and clearly stated analysis. With a close association to the Farm Bureau, Mr. Quinn’s father became a chemical wheat farmer. Headed down that same road, he pursued undergraduate and graduate degrees in botany at the Montana state land grant university, then completed a PhD at University of California Davis in plant biochemistry. Mr. Quinn grew up in the age of Secretary Earl Butz (Nixon and Ford Administrations), who infamously said to farmers, “Get big or get out.” Policies and financing pushed farmers to go with large chemical-intensive monocultures and end diversified operations.

Then there was that fateful field trip to the Central Valley in California during his PhD program in the 70’s that, he said “started me questioning the so-called modern trajectory of American agriculture.” He continued, “When my professor and the peach farmer started laughing about the way these peaches were ‘ripened’—using a petroleum-based spray developed by the professor that changed their color artificially—I was horrified. My disgust only deepened as I realized that the punch line of their joke was how they’d buried the results of their trials in an obscure journal overseas to avoid public scrutiny. This wasn’t the science I’d fallen in love with as a youth, the science that endeavored to uncover the inner workings of nature’s genius for the benefit of humanity. This was manipulative. Literally tasteless. And potentially harmful. I saw that the agriculture I was being trained in, industrial agriculture, was undermining fundamental human values. Honesty, for one. But also respect for the natural world and for the interconnections among living systems that I was just beginning to grasp. Nutrition, taste, and environmental stewardship were all being sacrificed to an economic logic that I couldn’t

understand. . . . But one thing was patently clear: this new direction was not about meeting human needs; it was about increasing markets and profits—in total disregard of the quality of the end product.”

Mr. Quinn has dedicated his life to “moving away from a commodity mentality in favor of products that explicitly assign value to soil quality, rural livelihoods, climate stability and human health.” He cites the work of Sir Albert Howard, botanist and organic pioneer, who at the turn of the 20th century said that the health of soil, plants, animals, and people should be studied as one great subject.

The book reads like a memoir with well-researched and cited facts to bolster his experiences and clearly stated analysis.

The author explains his path to advance a business model for a profoundly different agricultural economy. This brought him to ancient grains and value-added agriculture, and practices that nurture life in the soil to support more profitable crops and a healthier environment—organic agriculture. So instead of the herbicides that were being pushed in modern agriculture, Mr. Quinn says, “We found diverse rotations, sound soil management, and careful monitoring” to control weeds. He recounts that he asked a chemical rep, “How many weeds do I need to have to make it worthwhile to spray.” He never responded. As the author says, “Monsanto wasn’t interested in economic thresholds. The company just wanted to sell as much chemical as possible.” A local banker in the early 90’s told Mr. Quinn that a chemical rep wrote him, “If any of your customers are proposing to abandon the proven methods of modern agriculture for the high-risk niche of organic production, we hope you will not support such a change by lending money to such an ill-conceived enterprise.”

Organic offers many lessons drawn from Mr. Quinn’s life on the farm and in business—his respect for nature and choice of crops, including ancient grains, orchard crops, vegetables, high oleic safflower oil for food and recycled as fuel, and more. As he says, the agricultural industrial complex and big pharmaceutical companies do not want answers to questions about annual obesity care costs at \$147 billion and diabetes at \$116 billion. Having proven that individuals can take on large economic interests with organic family farms, Mr. Quinn believes that together eaters have tremendous power to bring unresponsive corporations to their knees and force change in those practices that are leading to the destruction of the earth. Read this book for inspiration.



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