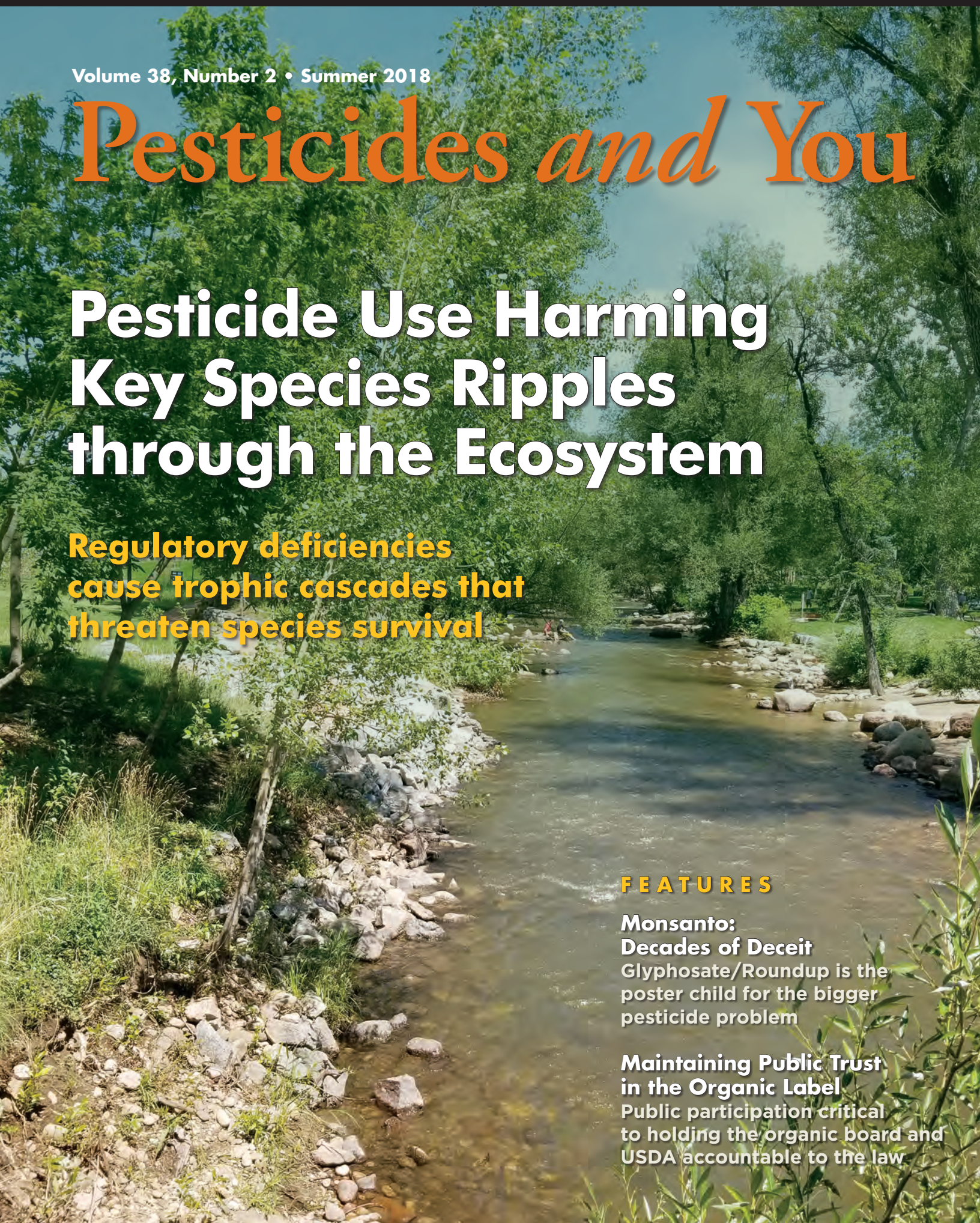
Beyond Pesticides: Protecting Health and the Environment with Science, Policy, and Action



Volume 38, Number 2 • Summer 2018

Pesticides *and* You

Pesticide Use Harming Key Species Ripples through the Ecosystem

Regulatory deficiencies cause trophic cascades that threaten species survival

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Monsanto: Decades of Deceit
Glyphosate/Roundup is the poster child for the bigger pesticide problem

Maintaining Public Trust in the Organic Label
Public participation critical to holding the organic board and USDA accountable to the law

Deception through Fraudulent Science and Public Relations Campaign

It is one thing to ignore science. It is quite another to deceive with science. The latter is exactly what investigative journalist Carey Gillam concludes in her talk in April to Beyond Pesticides' 36th National Pesticide Forum, *Organic Neighborhoods: For healthy children, families, and ecology*. Ms. Gillam's talk, in this issue of *Pesticides and You,* is a synopsis of her longer book, *Whitewash: The Story of a Weed Killer, Cancer, and the Corruption of Science*. In our cover piece, *Pesticide Use Harming Key Species Ripples through the Ecosystem,* we point out that the pesticide regulatory system does not assess the real effects of pesticides on the ecosystem, resulting in a cascade of impacts. Both these pieces support the need for and inform local action to restrict pesticides.

A Shift in Tone, Not Rollbacks, at EPA

Ms. Gillam's findings, based on internal Monsanto documents, emerge during a turbulent period at EPA, with the literal dismantling or disabling of environmental and public health programs and the resignation of EPA Administrator Scott Pruitt, caught up in ethics violations. His replacement, interim administrator Andrew Wheeler told the *Washington Post,* "[I] would say that the agenda for the agency was set out by President Trump. And Administrator Pruitt has been working to implement that. I will try to work to implement the president's agenda as well."

According to *The New York Times,* "Mr. Wheeler's actions signal a strategic shift at the EPA, an agency at the heart of President Trump's push to strip away regulations on industry. Under Mr. Pruitt, . . . the agency pushed for ambitious but fast-paced rollbacks of environmental rules. Mr. Wheeler, a former coal lobbyist who served as Mr. Pruitt's deputy, has brought a more disciplined approach to dismantling environmental rules."

Scientific Deception

Ms. Gilliam points out that, "Glyphosate is the poster child for the bigger pesticide problem." She continues, "If it goes away tomorrow, we are not okay." Because of this, Beyond Pesticides has strategically sought to transform our country's approach to pest management, both agricultural and residential/structural, by eliminating a reliance on pesticides and advancing organic management practices that do not rely on toxic inputs. In this context, pesticides like glyphosate, become an example of chemical industry influence resulting in inadequate underlying law and regulations. As environmental and public health groups engage in a whack-a-mole effort to remove specific pesticides, we must teach that these chemicals are not only dangerous to environmental health, but are unnecessary to prevent pests and achieve pest management goals.

Ms. Gillam provides succinct evidence of the pesticide industry's deception and attempts to besmirch legitimate scientists and science. As she explains, despite claiming to be shocked about the cancer finding for glyphosate by the International Agency for Research on Cancer (IARC) of the World Health Organization, an internal Monsanto document, *Preparedness and Engagement Plan for IARC Carcinogen Rating of Glyphosate,* was written before IARC even met. As Ms. Gillam says: "They knew it was going to come. They knew the science was there. They knew they were vulnerable. So they started laying out the plan of how to discredit IARC. It illustrates a long-term pattern. This didn't just begin with the IARC classification. If you go back through EPA archives, you can see that from the very beginning, wherever there was a sign of concern or harm associated with this pesticide, Monsanto figures out a way to make it go away, to tamp it down, to silence the person who's raising the alarm bells." Now, after trying to block the Agency for Toxic Substances Disease Registry review of glyphosate cancer data, Monsanto has its fingerprints on legislative report language on an appropriations bill in Congress that will prevent the agency from reviewing the data.

French Beekeepers Take Action

Meanwhile, as we report in this issue, about 200 members of a French beekeeping cooperative sued Bayer—on the same day the giant chemical company's acquisition of Monsanto was finalized—after discovering that their honey was contaminated with glyphosate. At the same time, researchers have found adverse health effects at glyphosate levels below those regulators deem "safe" or acceptable. These results represent the first phase of the Global Glyphosate Study based at the Ramazzini Institute in Bologna, Italy.

Continue to Press for Organic Integrity and Local Action

All this again affirms the need to have clarity on the alternatives to pesticides in clearly defined management systems that establishes allowed substances based on a rigorous cradle-to-grave health and environmental assessment, compatibility with nature and biodiversity, and essentiality, or necessity for the input. Beyond Pesticides continues to press for integrity and is fighting to uphold local authority to adopt more restrictive standards than state and federal law and ensuring that the integrity of organic law is maintained.

Jay Feldman, executive director of Beyond Pesticides

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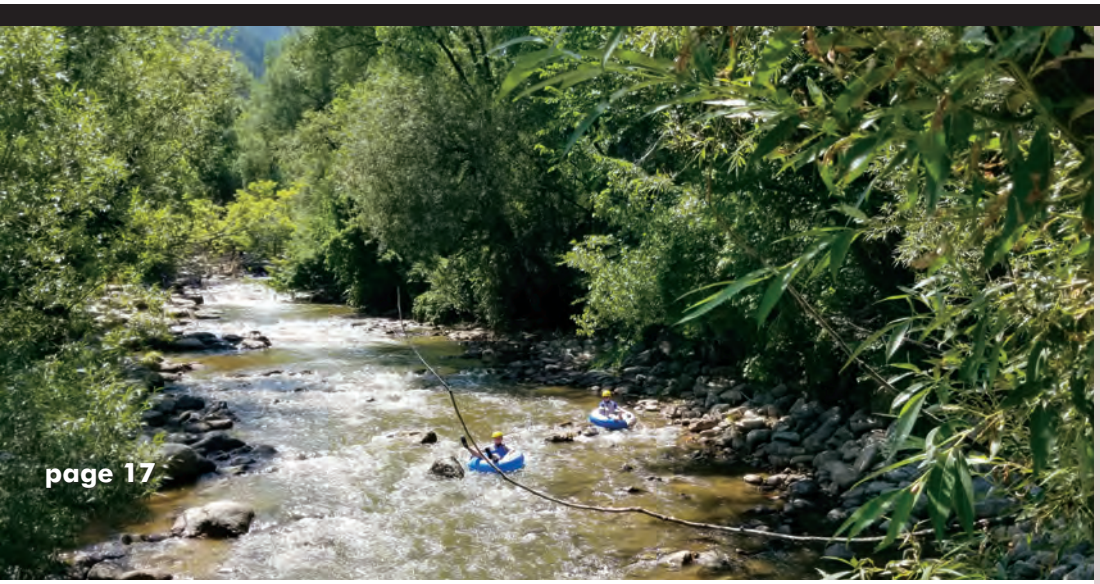

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Farmworkers Deserve Public Support

I'm very concerned about farmworker health and the health of their families. They are growing our food but are treated so poorly and they don't have good protections from toxic chemicals. What can I do to help them?

Tim, Sacramento, CA

Hi Tim,

You're 100% correct. Farmworkers toil day in and day out with exposure to the persistent hazards of toxic pesticides. Unlike other workers in the U.S., farmworkers are not protected under the U.S. Department of Labor's Occupational Health and Safety Administration. Instead, worker protection standards are contained within regulations of federal pesticide law, in a section called the Agricultural Worker Protection Standards. These standards, insufficient at their foundation, only recently received a modest update, representing a compromise between industry and farmworker advocacy organizations, after 20 years of delay. However, the Trump Administration has been working to undo major components of the update, reopening aspects of the new standards that established: training; small buffer zones after a pesticide application; a minimum 18-year-old age requirement to apply highly toxic pesticides, and; the opportunity to create a "designated representative" in the event a farmworker needs to obtain information about where and when pesticides were applied for legal or medical purposes. Media reports indicate that this move by the Trump administration is in lock-step with requests from the American Farm Bureau Federation, an umbrella group for the agrichemical industry.

Meanwhile, farmworkers continue to suffer. When compared to non-agricultural pesticide applicators, farmworkers are 37 times more likely to suffer from acute pesticide poisoning. Not only do farmworkers spend their days in chemically-treated fields, they typically live in agricultural communities being subject to pesticide drift from nearby farms while in their homes. The life expectancy of a farmworker in the U.S. is 49 years, compared to 78 for the general population. To put that in context, the last time that the general U.S. population's life expectancy was below 50 was in the 1850s.

There are ways we all can support farmworker efforts to gain the protections they deserve. First, spread awareness of their plight. Speak with your friends about farmworker issues, and share videos like the one from Beyond Pesticides' National Pesticide Forum panel in April, *Farmworkers, Families and Health*, which can be seen at *bp-dc.org/farmworkervoices*. Second, take action by contacting your members of Congress. You can send a letter by going to *bp-dc.org/nochildapplicators*, or, better yet, contact your congressional delegation directly through a phone call. Lastly, purchase organic whenever possible. Although organic does use pesticides like copper and sulfur, they are of significantly lower toxicity and used sparingly only in the context of a certified organic systems plan that is intended to avoid use. By promoting a safer food production system, we can help improve farmworkers' conditions. For more information, go to Beyond Pesticides' website at *bp-dc.org/agjustice*.

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 simply send questions and comments to: 701 E Street SE, Washington, DC 20003.

Using Data to Power Advocacy

The park up the street from me is spraying pesticides a lot more than I remember. How can I find out what they're spraying and stop it? I'm sick and tired of being poisoned.

Bill, Colorado

Hi Bill,

We're sorry to hear about the pesticide use occurring in your community. There are some ways we should be able to get information about the chemicals being used at the park you mention. To start, it depends on whether it is managed by the local, state, or federal government. If it is the local government, the town, city, or county, they should have an option for you to file a local public records request. Often, the local government clerk's office will respond to these requests, but they may need to be submitted to an individual department, such as Parks and Recreation or Public Works. A check of the community's website or call to your local government information line should be able to clear up where to send your request. If it is state land, your request will likely be dealt with through your state-level freedom of information or open records law. Similar to a local records request, you may need to send your letter to an individual department—in Colorado, for example, this will likely be the Department of Parks and Wildlife. If it is federal parkland, such as a national park, forest, or wildlife refuge, you will go through the federal *Freedom of Information Act* process. FOIA.gov is a helpful place to get contact information regarding the agency to target for your request.

Public records requests at every level of government need to be made formally, in writing. We suggest you make use of existing sample requests and edit them accordingly. A good place to find examples is the National Freedom of Information Coalition (*nfoic.org*), a 501(c)(3) nonprofit dedicated to protecting open records laws. You can also contact Beyond Pesticides at *info@beyondpesticides.org* for assistance or to receive a sample request form at *bp-dc.org/foia*. When describing what you are looking for, include enough detail for the public agency to respond. Be as specific as possible, but it is more important that you describe the information you are seeking. Do not deviate from your request by including any opinions or other extraneous details. Note that you may be charged a fee for some records requests in order to cover the staff time it takes the agency to gather your materials, but you should request a public interest waiver.

As the old saying goes, sunlight is often the best disinfectant. Beyond Pesticides encourages advocates to conduct public records requests as part of their organizing efforts. You may find, for example, that your community is using safer least-toxic products, or not spraying toxic pesticides at all (the liquid application you saw could be compost tea, for instance). If you do find evidence of toxic pesticide use, having this data available to you can help you galvanize public support. Beyond Pesticides' *Gateway on Pesticide Hazards and Safe Pest Management* (*bp-dc.org/gateway*) can be used to note the health effects for each chemical used in the community, and indicating the specific number of pounds or gallons of particular pesticides used, and acreage or areas treated, provides clarity and highlights the scope of the issue. You can make use of this data in petitions to local, state, or federal governments or raise public awareness by including it in op-eds or letters to the editor.

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 Action of the Week (6/4/2018): Tell USDA We Need Honest, Informative GE/GMO Labeling. As the deadline approaches for regulations on labeling genetically engineered (GE or GMO—genetically modified organism) food, the U.S. Department of Agriculture (USDA) has proposed a rule that fails in every important respect.
Kim Weber Russell responds via Facebook: Done. The new labeling proposals are devious. Why are they so anxious to hide GMOs in our food supply if there is no problem with them? I am disgusted with the lack of transparency. Consumers need to know what we are buying and feeding to our families, so we can make informed choices. There is a reason GMOs are banned completely in so many other countries.

Excerpt from Beyond Pesticides Daily News Blog (7/11/2018): Regenerative Farms Yield Soil Health and Higher Profits than Chemical-Intensive Operations. Ecologically-based farming systems contain far fewer pests and generate much higher profits than their conventional, chemical-based counterparts, according to research published in the journal PeerJ earlier this year by scientists at South Dakota State University and the Ecdysis Foundation.
Marcia Cash comments via Facebook: I have been organic gardening, small and large scale, for 45 years, and never lost a crop to bugs. The lizards and birds thrive on the bugs, and they all take a bite or two from the veggies, but I plant enough to share with them and all my human neighbors too.

Mission to Dismantle EPA Programs Continues with Resignation of Administrator Pruitt

Scott Pruitt's resignation as Administrator of the U.S. Environmental Protection Agency (EPA) took effect in July under a cloud of ethics investigations and alleged collusion with industry to systematically undermine, dismantle, and reverse critical protections for air, water, and workers. Andrew Wheeler will take the helm as Acting Administrator after serving as Deputy Administrator, a position that required Senate confirmation. Mr. Wheeler, a lawyer who worked in the toxics office at EPA under Presidents George H.W. Bush and Bill Clinton, as an aide to U.S. Senator Jim Inhofe (R-OK)— denier of climate change—and the Senate Committee on Environment and Public Works (EPW), and as a lobbyist for the coal and chemical industry. He told the *Washington Post*: "[I] would say that the agenda for the agency was set out by President Trump. And Administrator Pruitt has been working to implement that. I will try to work to implement the president's agenda as well. . . . [W]e're implementing what the president has laid out for the agency."

What's in a Pesticide Product Matters

Two studies add to the body of science identifying serious deficiencies in health assessments of toxic chemical exposure. One study, appearing in the *Federation of American Societies for Experimental Biology Journal* in April 2018, tackles the role of chemical pesticide exposures in the risk of developing Parkinson's Disease. The other, published earlier this year in the journal *Food and Chemical Toxicology*, assesses potential negative health outcomes of long-term,

More Bad News on Glyphosate/Roundup

In the wake of U.S. Department of Justice (DOJ) approval of the buyout of Monsanto by Bayer, the new mega-corporation—now the world's largest agrochemical and seed company—announced that it will drop the "Monsanto" name. Meanwhile, the news for the new company regarding its Roundup/glyphosate products is bad on several fronts.

In April, an Appellate Court in California upheld the State of California's listing of glyphosate as a probable carcinogen under the state's Proposition 65 (Prop 65), rejecting Monsanto's challenge. The state will not only move ahead with warning labels on products that contain glyphosate, but also prohibit discharge of the pesticide into public waterways.

In a case filed under the District of Columbia's Consumer Protection Procedures Act, a U.S. District judge ruled that Beyond Pesticides and the Organic Consumers Association presented enough evidence to support their contention that Monsanto's labeling of its flagship weedkiller, Roundup, misleads consumers by labeling it as "target[ing] an enzyme found in plants but not in people or pets." The enzyme targeted by glyphosate attacks beneficial bacteria essential to human health, adversely affecting the gut biome and contributing to a range of diseases.

About 200 members of a French beekeeping cooperative sued Bayer—on the same day the giant chemical company's acquisition of Monsanto was finalized—after discovering that their honey was contaminated with glyphosate, a known endocrine disruptor and probable human carcinogen. Meanwhile, researchers have found adverse health effects at glyphosate levels below those regulators deem "safe" or acceptable. These results represent the first phase of the Global Glyphosate Study based at the Ramazzini Institute in Bologna, Italy.

According to a study published in March in *Environmental Health*, women with high levels of glyphosate in their bodies are more likely to have shorter pregnancies, which can lead to children with reduced learning and brain development. Granola, cereals, and wheat crackers all contain "a fair amount" of glyphosate, according to internal emails from the Food and Drug Administration (FDA). FDA now says it will be conducting tests for glyphosate in food.

low-dose exposure to real-life chemical mixtures, rather than single chemical exposures typically used in laboratory testing. These studies underscore the need to consider synergistic and low-dose exposures in the development of genuinely protective public health and environmental regulations.

A *Frontiers in Public Health* review finds that there is no scientific basis for regulations that distinguish "other/inert" and "active" ingredients when assessing pesticide product safety. Active ingredients are specifically included in products to attack the target pest, while "inert" or "other" ingredients typically make up the majority of the formulation (liquid, dust, granule, sticking agent, or surfactant) and can be as or more toxic than the active ingredients. Only "active" ingredients undergo a full risk assessment before being sold to the public.

Declining Biodiversity Adversely Affects Human Health

Children who live in "green" neighborhoods have reduced risk of developing asthma, based on a longitudinal study with New Zealand subjects. The authors say results "suggest that exposure to greenness and vegetation diversity may be protective of asthma."

Meanwhile, biodiversity is declining, at a disastrous rate. A Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services report shows that unsustainable exploitation of natural resources worldwide has reached critical proportions, threatening the food and water security of an estimated 3.2 billion people. The annual count of Monarch butterflies overwintering in Mexico shows declines from last year's numbers—a 15 percent decrease—according to figures from an official Mexican government count in the winter of 2017. Two recent studies show staggering declines in bird populations throughout the nation.

Proposed Labeling for Genetically Engineered Food: Misleading and Discriminatory

As the deadline approaches for regulations on labeling genetically engineered (GE or GMO—genetically modified organism) food, the U.S. Department of Agriculture (USDA) has proposed a rule that it previously characterized as discriminatory: It allows GE information to be conveyed by QR codes, which requires a cell phone (with camera function) and a reliable broadband connection, and allows GE food to be identified as "bioengineered" or by a smiley-face symbol containing the letters "BE." It does not cover highly processed GE foods, like vegetable oils or sugar, and does not include newer genetic engineering techniques, such as CRISPR (a gene editing tool).

Beyond Pesticides and other groups have called on USDA to require labeling with only well-established terms, such as GE or GMO, not allow use of the term "bioengineered," and drop the blatantly biased "smiley face" sun.

© Assoc. of Farmworker Opportunities

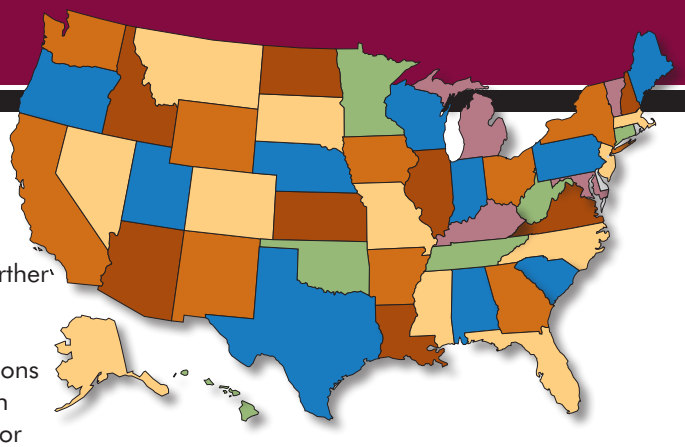
Fighting to Protect Farmworker Children

In response to a U.S. Environmental Protection Agency (EPA) rollback in its plans to improve protection of farmworker children, lawmakers, states, and public interest groups are fighting back. At issue are two EPA proposals that undermine Agricultural Worker Protection Standards (AWPS) and the Certification of Pesticide Applicators (CPA) rules put in place during the Obama Administration to update agricultural worker protection standards—including expanded training, prohibition of allowing children under 18 to apply highly toxic restricted use pesticides, new no-entry application-exclusion zones, improved record keeping, providing farmworkers a designated representative to request pesticide records, and other safety improvements.

In March, 28 U.S. Senators urged the preservation of the rules. Later that month, the U.S. District Court for the Northern District of California ruled that EPA illegally delayed implementation of key pesticide rules that in part prevent minors from working with the most dangerous pesticides—which EPA said could prevent some 1,000 acute poisonings every year.

States and non-profits launched new lawsuits in late May against EPA for its continued attack against farmworker health and safety. Two separate lawsuits, one filed by attorneys general in the states of California, Maryland, and New York, and another by health and justice advocates represented by Earthjustice and Farmworker Justice.

These lawsuits focus on EPA's continued delay of the mandatory training requirement for farmworkers, which details pesticide safety for workers and steps that can be taken to reduce exposure to their children and loved ones after working all day in a contaminated field.



Tightening Restrictions on Bee-Toxic and Synthetic Pesticides Worldwide

Canada. Health Canada is proposing to phase out a number of uses of neonicotinoid insecticides in order to mitigate risks to pollinators. The agency has completed its review of clothianidin and thiamethoxam—two neonicotinoids that have been linked to pollinator decline—and finds risks of concern for bees. These measures do not go as far as those recently adopted in the European Union, but go further than label restrictions issued by EPA. Health Canada concluded its pollinator re-evaluation for clothianidin and thiamethoxam after examining hundreds of laboratory and outdoor field studies. The agency finds that uses of these neonicotinoids have "varying degrees of effects on bees," and that some uses "may pose a risk of concern to bees." Instead of a complete ban of the neonicotinoids, however, the agency is proposing mitigation measures to minimize potential exposure to bees, which includes the phase-out of many uses and certain additional product label restrictions.

European Union. In April, European Union (EU) member states backed a proposal to further restrict uses of neonicotinoids, finding the pesticides' outdoor uses harm bees. These restrictions go beyond those already put in place in 2013, and ban outdoor uses of clothianidin, imidacloprid, and thiamethoxam. Uses will only be allowed in permanent greenhouses where contact with bees is not expected. The General Court of the European Union (GCEU) upheld the EU action in response to a challenge by multinational seed and chemical companies, Syngenta and Bayer—manufacturers of the neonics in question, that argue bees are not harmed if farmers follow label instructions. The court ruled in favor of taking precautionary action.

Washington State. The Washington State Department of Ecology denied a permit to spray Willapa Bay and Grays Harbor with imidacloprid to kill native burrowing shrimp in beds of commercial Japanese oysters after it determined "environmental harm from this neonicotinoid pesticide would be too great." Concerned residents and environmental advocates opposed to the proposed use cite harm to aquatic life, including fish habitat, and long-term ecological damage.

Scientists Advocate Action, California. A group of 56 scientists studying the effects of neonicotinoids sent a letter to California's Department of Pesticide Regulation (DPR) highlighting the threat neonicotinoids pose to the health of California's waterways and urging that steps be taken to reduce neonicotinoid contamination of the state's streams and rivers. According to the letter, neonicotinoids are already found in California waterways at levels that exceed the freshwater invertebrate aquatic life benchmarks and could harm or kill many sensitive aquatic invertebrate species. Similarly, neonicotinoids are pervasive throughout the Great Lakes, and federal assessments confirm high risks to aquatic species. Imidacloprid samples in California from 2010–2015 show that 42% of detections exceed the acute invertebrate benchmark and all of the detections exceed the chronic invertebrate benchmark. In certain regions of the state, particularly agricultural areas, the imidacloprid benchmark for acute effects is more frequently exceeded. The scientists note these chemicals can "have consequences for broader ecosystems. Declines in aquatic invertebrates put other species at risk, particularly insectivorous fish, amphibians, and birds. Changes in aquatic invertebrate communities resulting from exposure to insecticides can also affect ecosystem functions, potentially leading to increased methane production or upsurges in pest species like mosquitoes."

Switzerland to Vote on Banning Synthetic Pesticides. After more than 100,000 Swiss citizens signed a petition

calling for a ban on pesticides, Switzerland will soon have to vote on a complete ban on the use of synthetic pesticides. The ban would apply to farmers, industries, and imported goods, and advocates hope other EU nations will follow. Switzerland, home of the world's largest pesticide manufacturer, Syngenta, has been engaged in the debate raging across the EU about the future use of pesticides. Recently, the EU reapproved glyphosate (Roundup) after months of deadlock, while certain countries, including France, have indicated that it will ban the chemical within three years. If successful, the Swiss initiative will make it the first country in Europe and the second in the world, after Bhutan, to ban all synthetic pesticides.

Connecticut Bans Pesticide Misters

The Connecticut state legislature voted to ban the use of residential pesticide misting systems. (These are devices that are typically placed outdoors and spray insecticides—mostly in an attempt to control mosquitoes.) This is the latest move by a state legislature that has also recently banned the use of bee-toxic neonicotinoids and stopped the use of hazardous lawn care pesticides on public playgrounds. The vote was unanimous in the state Senate, and won by a count of 132–17 in the state House of Representatives. The chemicals employed in these machines are often synthetic pyrethroids, which have been linked to a range of human health effects, from early puberty in boys, to behavioral disorders, learning problems, ADHD, and certain cancers.

Maine Rejects Preemption of Local Authority to Restrict Pesticides

An industry-backed attempt to enact pesticide preemption in the state of Maine is officially over after the legislation was voted down by a 9–2 margin in April. The bill, introduced by state Senator Tom Saviello (R-Wilton), resembled a similar bill that failed in the same legislative committee in 2017. With an ever-increasing number of communities in Maine stepping up to protect their residents and unique local environments from pesticide contamination, the repeated introduction of preemption legislation means that health advocates and forward-thinking communities must continue to remain vigilant, and ready to fight to maintain their right to home rule. LD 1853 would have taken away the rights of Maine municipalities to enact policies that apply to private property. The U.S. House of Representatives passed a provision in its Farm Bill, not in the Senate bill, to preempt local authority nationwide. At this writing, the issue is in conference committee.

Hawai'i Becomes First State to Ban Chlorpyrifos

In June, Hawai'i Governor David Ige signed legislation to ban the dangerous neurotoxic pesticide chlorpyrifos. The statewide prohibition, which will take effect in January 2019, received unanimous support from lawmakers on both sides of the aisle. This legislative action marks the first time that any state in the country has passed an outright ban of the highly toxic organophosphate pesticide. While multiple scientific studies have determined that chlorpyrifos damages fetal brains and produces cognitive and behavioral dysfunctions, particularly in utero and in children, EPA retracted the federal ban, and states have been slow to institute a complete prohibition, due to its widespread use in agriculture. Lawmakers in New Jersey and Maryland have recently tried unsuccessfully to pass similar bans. Hawai'i's bill contains a caveat that allows the state's Department of Agriculture (DOA) to grant special permits for companies that argue that they need more time to phase-out chlorpyrifos, but the exemption will end at the close of 2022.

Creative Commons/Courtesy of Hawaii Senate

U.S. Wildlife Refuges Contaminated with Toxic Pesticides

According to the report *No Refuge*, published in May by the Center for Biological Diversity, hundreds of thousands of pounds of pesticides are sprayed on lands that are designated as refuges for wildlife and protected under U.S. law. Approximately 490,000 pounds of pesticides were sprayed on crops grown in national wildlife refuges in 2016 alone. The nation's 562 national wildlife refuges play a critical role in protecting fish, plants, and other wildlife. They include forests, wetlands, and waterways vital to thousands of species of plants and animals, including 280 that are protected under the *Endangered Species Act*. However, private chemical-intensive commercial farming of crops, such as corn, soybeans, and sorghum, has become common on refuge lands, with the increasing use of highly toxic pesticides that threaten the long-term health of sensitive habitats and the creatures who depend on them. Pesticide use in these sensitive areas poses risks to pollinators, aquatic organisms, migratory birds, and other wildlife that need protection. The report analyzes pesticide use on national wildlife refuges using records obtained through a *Freedom of Information Act* request. The report finds that in 2016 more than 270,000 acres of refuge lands were sprayed with pesticides for agricultural purposes. Bee-toxic neonicotinoid insecticides were banned on refuges in 2016.

California Failing to Protect At-Risk Communities

A report by California Environmental Justice Alliance (CEJA), which assesses state agencies on eight environmental justice principles, finds California's Department of Pesticide Regulation (DPR) is falling short in protecting vulnerable communities in the state, especially low-income and communities of color. The poor showing by DPR comes as agency reports show that the state's pesticide use has increased to 209 million pounds of pesticide active ingredients in 2016, nearing record highs. CEJA's 2017 Environmental Justice Agency Assessment provides full assessments of nine key agencies in the state, giving DPR poor grades for its persistent failure to prioritize community health over industry profits. The report concludes, "[M]any state agencies still make decisions that actively harm [communities of color]."

Monsanto Weedkiller Banned by Two States

In a stark departure from inadequate EPA restrictions, both Arkansas and Missouri in early July issued statewide bans on the sale and use of the Monsanto weedkiller dicamba by farmers. Crop damage is associated with the pesticide's drift off treated fields onto crops not genetically engineered to be tolerant of the herbicide. On July 7, the Arkansas Agriculture Department announced this emergency 120-day ban, which raised civil penalties for misuse of the toxic herbicide from $1,000 to a maximum of $25,000. The same day, the Missouri Department of Agriculture announced a temporary Stop Sale, Use or Removal Order on all dicamba products in the state labeled for agricultural use. Dicamba has been linked to damage of the kidney and liver, neurotoxicity, and developmental impacts. However, it is the chemical's strong propensity to volatilize small particles of the herbicide into the air and drift far off-site that is driving the bans. Sensitive crop species can be damaged by dicamba at levels in the parts per million.

As of July 7, nearly 600 complaints of dicamba damage have been filed by Arkansas farmers in 23 different counties. In Missouri, as of July 3, there are 123 cases of dicamba injury complaints under investigation and, according to the Missouri Soybean Association, "More than 200,000 Missouri soybean acres currently show signs of suspected dicamba damage." According to the University of Missouri, there are "600 cases being investigated by the state departments of agriculture and approximately 1.1 million acres of soybean estimated with dicamba injury by university weed scientists [in 14 states]."

A lawsuit filed by a Kansas farmer in July claims that Monsanto knew its new dicamba-formulated product would harm non-target crops, but marketed and sold it anyway, damaging thousands of acres. The plaintiff, 4-R Farms based in Corning Kansas, lost over 200 acres of soybeans.

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Federal Indictment in Virgin Islands Poisoning

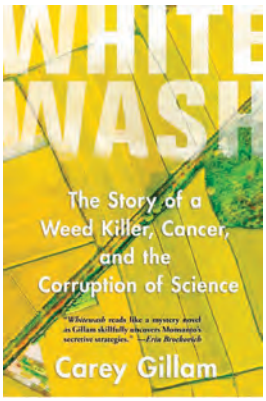
In a case that appalled the nation, the U.S. Justice Department finally in early April secured an indictment against an applicator who illegally applied a fumigant at a U.S. Virgin Island resort, causing devastating and long-term health effects to a family on vacation. Terminex has already been fined and paid a multi-million dollar settlement to the poisoned family. Jose Rivera, 59, was indicted by a federal grand jury for violating the *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA). According to the indictment, Mr. Rivera illegally applied fumigants containing methyl bromide in multiple residential locations in the U.S. Virgin Islands, including the condominium resort complex in St. John, where the family of four fell seriously ill in March 2015.

Monsanto: Decades of Deceit

Glyphosate/Roundup is the poster child for the bigger pesticide problem

CARY GILLAM

Carey Gilliam is the research director for U.S. Right to Know and author of Whitewash: The Story of a Weed Killer, Cancer, and the Corruption of Science. *She has written about food and agriculture for over 25 years as a staff writer for Reuters. The following is excerpted from her talk at the Beyond Pesticides' 36th National Pesticides Forum, Organic Neighborhoods: For healthy children, families, and ecology, in April, 2018 at the Beckman Center of the National Academies of Sciences in Irvine, California. For a complete video of Ms. Gilliam's talk, please go to Beyond Pesticides' YouTube channel at* bp-dc.org/monsantodeceit.



I am honored to be invited to speak to the Forum. You guys are the people who know this stuff. A lot of you sitting in the audience are my sources—the people who have helped inform me and helped me write *Whitewash*.

I have to open with a disclaimer. I'm a journalist. I've been one for more than 25 year. And, I'm far more comfortable sitting where you are and listening to a presentation and probably writing a story about it. We journalists are not oriented towards activism. I have been trained to put aside my own opinions and my own biases—and simply stick to the facts, and pursue the truth wherever it may lead you, however deeply it might be hidden, and whoever it might offend.

With the book *Whitewash*, I've offended quite a few people, I think. So standing here isn't comfortable for me. I'm here, both because Beyond Pesticides invited me to be here, and because after 20-some years writing about food and agriculture for Reuters, it just became impossible not to do this—not to speak out, not to write a book. Even though you all have known this longer than I have, it became abundantly clear to me that we have lost our way. We're out of balance with this world. We've allowed pesticide-dependent agriculture to take over and we're putting our future generation, including my three children, in danger.

The research by the group I work for, U.S. Right to Know, and the research by Beyond Pesticides and so many others, has made it clear that not only are we out of balance, but we're out of balance by intention, strategically so. And this is designed by a handful of very powerful companies that control the seeds and the chemicals that dominate the modern agricultural system that they have created. They aim primarily to generate ever-greater profits. So while we are being poisoned and our future generations are being put in danger, they are counting their profits. And that's something you can't be quiet about.

PERVASIVE GLYPHOSATE/ROUNDUP

My primary area of focus, lately, has been glyphosate. Glyphosate is the active ingredient in hundreds of herbicide products sold around the world, but most people know it as Roundup, which Monsanto introduced to the market in 1974. Monsanto patented glyphosate as a novel herbicide. It worked great, was very effective, and claimed to be so much safer than other herbicides on the market. It was pretty quickly embraced and is still to this day very popular. Today, about 300 million pounds are used per year in the United States. We're seeing it in parks, children's playgrounds, and on lawns and gardens. Residential homeowners are using it. Golf course operators are using it to keep the greens neat and nice looking. So many people here are so deeply invested in this, but I don't think a lot of people realize how pervasive it is. And, of course, it's used in food and agriculture.

The U.S. Environmental Protection Agency (EPA) tracks over 70 different food crops on which glyphosate is used. It's not

just genetically-altered corn, or genetically-altered soy, cotton, canola, or sugar beet. It is used in almond orchards, orange groves, and tea plantations. It is the most widely used agrichemical in the world.

As a result, not only is it in our food, it's in our drinking water, our soil, the air, in our own bodies. It's been found in urine tests around the world. It's pervasive in our world today.

GLYPHOSATE IS THE POSTER CHILD FOR THE BIGGER PESTICIDE PROBLEM

The work that I have done recently is focused on glyphosate, and *Whitewash* focuses on Monsanto and how it pushed glyphosate to such prominence. But, glyphosate is the poster child for the bigger pesticide problem. If it goes away tomorrow, we are not okay. But I do think that it is very representative of what is going on in terms of the way that it has been pushed, and the way the company has manipulated public policy and the regulatory authority.

THE FACTS ABOUT PESTICIDES

A few "not so fun facts" about pesticides:

- Over one billion pounds of pesticides are used in the U.S. each year.
- Approximately 5.6 billion pounds of pesticides are used worldwide.
- The U.S. Department of Agriculture has estimated that 50 million people in the U.S. obtain drinking water from groundwater that is potentially contaminated by pesticides and other agricultural chemicals.
- Glyphosate is the world's most widely used weed-killing pesticide, but research ties many others to health problems, including reproductive and neurodevelopmental harms, as well as cancers.
- The top scientist at National Institutes of Health, Linda Birnbaum, PhD, wrote a paper with colleagues, and this phrase really struck me: "U.S. regulations have not kept pace with scientific advances showing that pesticides and other widely used chemicals cause serious health problems at levels previously assumed to be safe."

We know that these pesticides are tied to cancers, right? There are many studies that have been done around the world, but the Agricultural Health Study is a good one because it has been tracking 89,000 farmers and their family members since 1993. These are farmers in Iowa and North Carolina who are exposed to a lot of pesticides, and they found overwhelming evidence of ties to a whole range of cancers: breast, ovarian, thyroid, kidney, non-Hodgkin lymphoma (NHL), as well as Parkinson's disease.

My son's 16-year-old friend was diagnosed with cancer last year. He's a football player. Two weeks ago my husband's sister was diagnosed with uterine cancer. On December 14, I lost a dear friend to pancreatic cancer. My tennis partner just had surgery, her second surgery last week after going through chemo and radiation and a major surgery. I used to ask people to raise their hand if they knew someone that had cancer. Now, raise them if you don't. This is not okay. And this is why I'm doing this. I don't see this getting any better:

- Approximately 39% of men and women in the U.S. are expected to be diagnosed with cancer in their lifetimes.
- More than 600,000 are expected to die, this year, from cancer. More than 1.6 million are expected to be newly-diagnosed with cancer. Pediatric cancers are among those on the rise.
- Worldwide, more than 14 million cases of cancer occur each year, and that number is expected to hit 22 million a year by 2030.
- Research suggests a connection between pesticides and cancers such as NHL, multiple myeloma, and prostate, liver, pancreatic, lung, and non-melanoma skin cancers.
- The 2016 National Toxicology Program (NTP) report says that to reduce cancer deaths we must address environmental causes, including pesticides. The line in the NTP study that struck me is: "We need to stop focusing so much on how we fix it, how we treat it, how we live with cancer, and how we cut body parts off, and start preventing it and identifying these environmental contaminants, including pesticides."

GLYPHOSATE CLASSIFIED AS A CARCINOGEN

Back to my poster child. In 2015, the World Health Organization (WHO) cancer experts at the International Agency for Research on Cancer (IARC) decided to take a look at glyphosate. A number of independent studies, as well as company studies, have been done over the past few decades, as glyphosate uses increased. Scientists all around the world have done toxicology studies—animal studies, as well as epidemiology, and some mechanistic studies—looking at not only glyphosate by itself, but also at the formulated products, like Roundup. IARC doesn't do new research. It looks at the published peer-reviewed work and weighs and analyzes it. Then they come up with a classification. In the case of glyphosate, they found that it was a "probable human carcinogen," classified as 2A. They found sufficient evidence in the lab animal studies, and limited evidence of cancer in humans. They found strong evidence of DNA damage. They looked at people who lived in areas where there had been aerial spraying of glyphosate and they were exposed in that way—there was DNA damage in those individuals, compared to control groups. So it was pretty stark. And when they put it all together, produced a glyphosate hazard evaluation. (See Figure 1.)

MONSANTO LAUNCHES CAMPAIGN AGAINST SCIENCE

Everything changed with this classification in March of 2015. Monsanto was outraged at this. I worked at Reuters at the time. I was talking with Hugh Grant, the chairman of Monsanto. They were outraged, stunned, shocked, and surprised. They

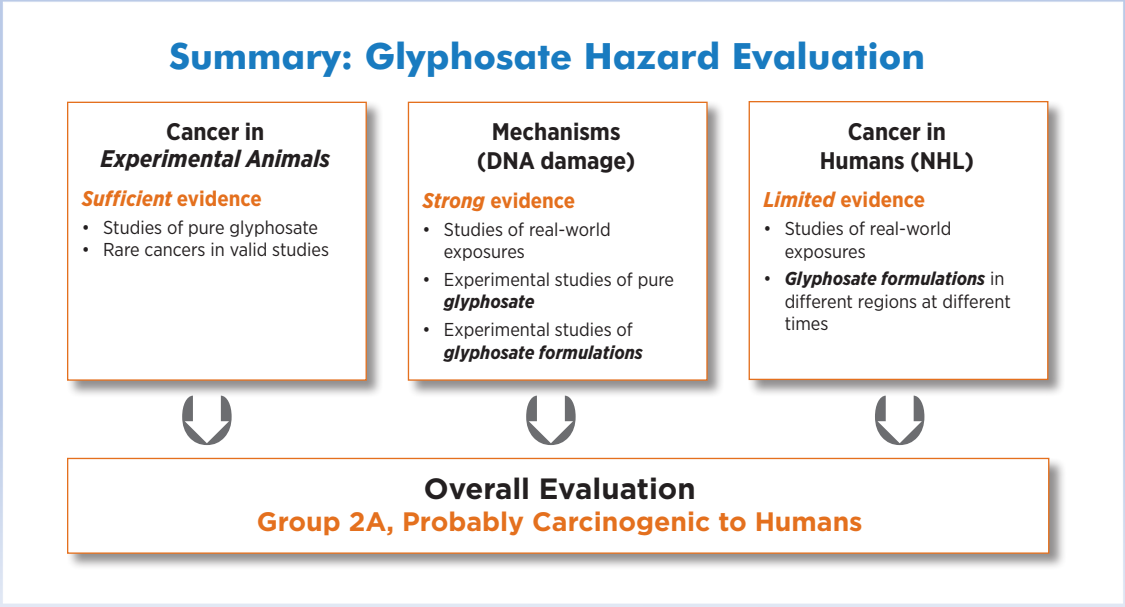


FIGURE 1:
Summary—Glysophate Hazard Evaluation

Source: Carey Gillam

said, "How could this happen? There's absolutely no evidence that this chemical can cause cancer. It's ridiculous. These people were relying on junk science and politically motivated, and had all sorts of agendas. And, it's a terrible thing, and no one should believe it."

They've continued to take this position for the past three years. They've been so successful that, on February 6 of this year, the Committee on Science Space and Technology, U.S. House of Representatives, held a hearing specifically to attack IARC, and to consider and discuss options for defunding IARC—to strip funding from our international cancer scientists specifically because they found that glyphosate was a probable human carcinogen.

VICTIMS OF ROUNDUP SUE

The IARC classification prompted an explosion of litigation as well. A very conservative estimate of 3,500 plaintiffs around the U.S. are suing Monsanto. These are people who either have developed NHL, or they are surviving family members of those who died from NHL. They're suing in state and federal court. All of these lawsuits allege that Monsanto's Roundup caused them to develop NHL, and that Monsanto knew and covered up the risks.

The first trial is scheduled to begin in San Francisco county June 18 of this year. [Note: It did begin.] It will be fascinating. The lawyers involved tell me they have well over 10,000 plaintiffs waiting in the wings. Monsanto is very concerned about this. They've filed motions—unsuccessfully—to try to get all of these lawsuits dismissed. The plaintiff in the case that is going to trial June 18 is not sure that he will survive until the court date, and Monsanto is trying very hard to get a delay. The judges said: "No. We're not going to do that."

As a result of this litigation, Monsanto is forced to turn over millions of pages of internal reports, documents, emails, memos, and different studies. When you look at those along with documents that I and my colleagues at U.S. Right to Know have obtained through the *Freedom of Information Act* from EPA, the U.S. Department of Agriculture (USDA), the Food and Drug Administration (FDA), and various state universities, it's a pretty incredible picture of collusion, deception, and deceit.

I was asked to speak to the European Parliament in October, and the title of my presentation was "Decades of Deceit." They had asked me to speak about Monsanto and glyphosate. As I was sitting there, about to address Parliament, I thought: "God, that's a really strong title. Am I okay with that? Well, yeah. Because that is what it is. It is decades of deception."

A DECEPTIVE CAMPAIGN

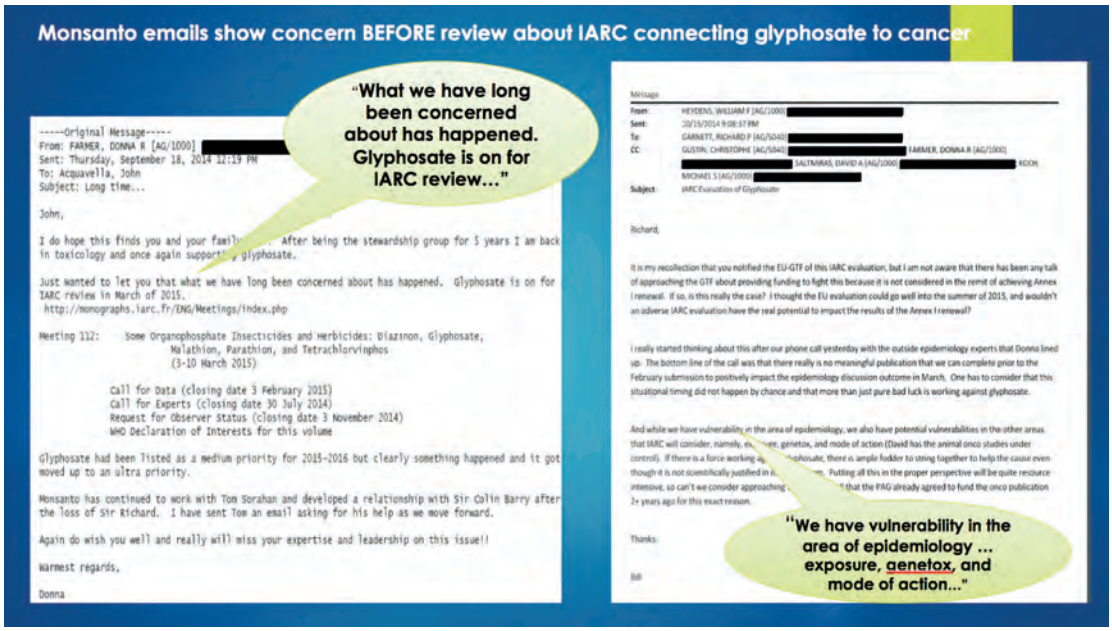
I can't put what all the documents show in a presentation, but you can read *Whitewash*. The documents show all of these different things: ghost-written research papers that assert glyphosate's safety for publication and regulatory review; alternative assessments provided for studies that indicate harm. So if a regulator is looking at a study and says, "Gosh, this looks like it causes cancer," Monsanto will then give them the rationale for how to interpret the data in a different way. They have networks of European and U.S. scientists that push the safety message to lawmakers and regulators. They *appear* to be independent, so they appear to be more authoritative and authentic. But behind the scenes we see documents that show that Monsanto is helping them or telling them what to say, or assigning them a task.

Public relations teams are ghost-writing articles and blogs. They appear on different sites on the web or in different magazines—again, looking like they are coming from an independent scientist.

FIGURE 2:

Internal Monsanto emails expressing concern about cancer review.

Source: Carey Gillam



They form front groups. These front groups work to discredit IARC, or any scientist, individual, or journalist, like me, and others who try to speak out or address this. They provide the EPA with talking points to address. That one got me when I saw that: "Talking points. From Monsanto to the EPA."

One thing that I thought was really outrageous. They actually have blocked the conducting of safety reviews by the Department of Health and Human Services, the National Toxicology Program. Monsanto was able to block that.

These are some of the emails that are fun to look at. So even though Monsanto claimed it was so surprised and so outraged and shocked that IARC could come up with a 2A probable human carcinogen ranking, you can see in the emails that Monsanto kind of thought that was where things were going to go. And they were very worried about this when they learned IARC was going to look at glyphosate. (See Figure 2.) You see in the memos: "What we have long been concerned about has happened. Glyphosate is on for IARC review." From the fall of 2014, emails talk about lining up help from independent scientists. They're girding for battle; they know what's going to come. They're talking about getting money together. They're talking about the "fight" that is going to come. They talk about how vulnerable they are with this science. One memo, again, before IARC met, says, "We should assume and prepare for the outcome of a 2B (possible carcinogen) or 2A (probable carcinogen)." (See Figure 3.) They knew it was coming. A Monsanto document titled "Preparedness and Engagement Plan for IARC Carcinogen Rating of Glyphosate," was written before IARC even met. (See Figure 4.) They knew it was going to come. They knew the science was there. They knew they were vulnerable. So they started laying out the plan of how to discredit IARC.

It illustrates a long-term pattern. This did not just begin with the IARC classification. This began in the 1980s, or late 1970s. If you go back through EPA archives, you can see that from the very beginning, wherever there was a sign of concern or harm associated with this pesticide, Monsanto figures out a way to make it go away, to tamp it down, to silence the person who is raising the alarm bells.

MONSANTO GHOST-WRITES JOURNAL ARTICLES

There is another thing that came out from the emails, pertaining to the ghost-writing in an internal communication from Monsanto executive Bill Heydens, as they are talking about discrediting IARC. They're trying to figure out how to get another paper written. And you see Mr. Heydens saying: "An option would be to add Greim and Kier or Kikland to have their names on the publication, but we would be keeping the cost down by us doing the writing and they would just edit and sign their names, so to speak. Recall that is how we handled Williams, Kroes, and Munro, 2000." So what they're saying is they're going to pay scientists to put their names on it, but Monsanto scientists will actually do the writing.

The work, signed by Williams, Kroes, and Munro, is one of the most highly regarded papers by regulators. It's been cited hundreds of times. It is cited by EPA at the very top of its evaluation of glyphosate. It is a paper that they have relied on.

The paper is "Safety Evaluation and Risk Assessment of the Herbicide Roundup and Its Active Ingredient, Glyphosate, for Humans." The paper found that Roundup does not pose a health risk—no effects on fertility or reproduction—and is non-carcinogenic. And this is very nice. It doesn't say anywhere on it that Monsanto just paid these scientists to sign their names.

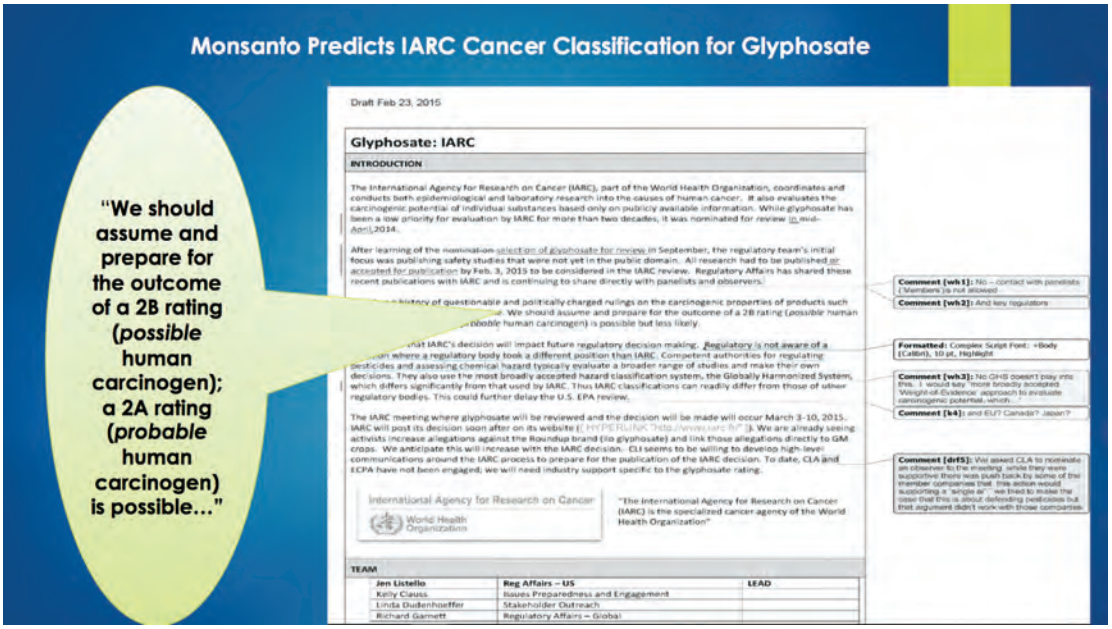


FIGURE 3:
Monsanto prepares to fight cancer classification for glyphosate before outside evaluation begins, expressing expectation it will be ranked a carcinogen.

Source: Carey Gillam

Another example—David Saltmiras, PhD, another Monsanto scientist, brags that he ghost-wrote the cancer-review paper, Greim et al., 2015. And this Greim paper, again, was cited by EPA in its risk assessment of glyphosate as being a very important paper. Dr. Saltmiras, listed as an author, refers to his ghost-writing the paper. Helmut Greim, M.D. is an 82-year-old German scientist who some people are not sure actually did much writing. So it seems that Dr. Saltmiras was talking about ghost-writing it, even though Dr. Greim is listed as the lead author. Again, this paper comes up with no evidence of a carcinogenic effect related to glyphosate. "Compelling weight of evidence support the conclusion glyphosate does not present the concern with respect to carcinogenic potential."

This next one was specifically designed to counter IARC. Monsanto came out and said it was going to hire a group of scientists to do an independent review of glyphosate safety and IARC's papers. Monsanto said, "We are hands off. We don't have anything to do with this." The acknowledgements say, "Neither any Monsanto company employees nor any attorneys reviewed any of the expert panel manuscripts prior to submission to the journals." This series of papers was published in a peer-reviewed journal. They have this disclaimer, this acknowledgement that no company employees of Monsanto looked at it.

Yet, in the documents from Monsanto, they're writing the draft, they're editing, they're changing things, they're moving things around. They're getting in an argument with one of the authors.

These are very clearly tampered with or ghost-written by Monsanto, but if you go to the journal today, you don't see any indication of that. They appear to be independent, and, in fact, that is the title of this work.

My last example, from 2011, is Donna Farmer, PhD, a toxicologist at Monsanto. She writes internally about how she is adding a section in the paper. She's doing some cutting and pasting about POEA surfactant studies—a very big concern. She talks about all the work she's doing on this very important paper that is looking at reproductive issues. Nevertheless, POEA has been banned in Europe because of its dangers.

When the paper is published, you can see that Dr. Farmer's name is no longer on that paper. There is no mention of Monsanto on that paper, which very helpfully concludes that there's no reproductive harm or concern at all tied to glyphosate.

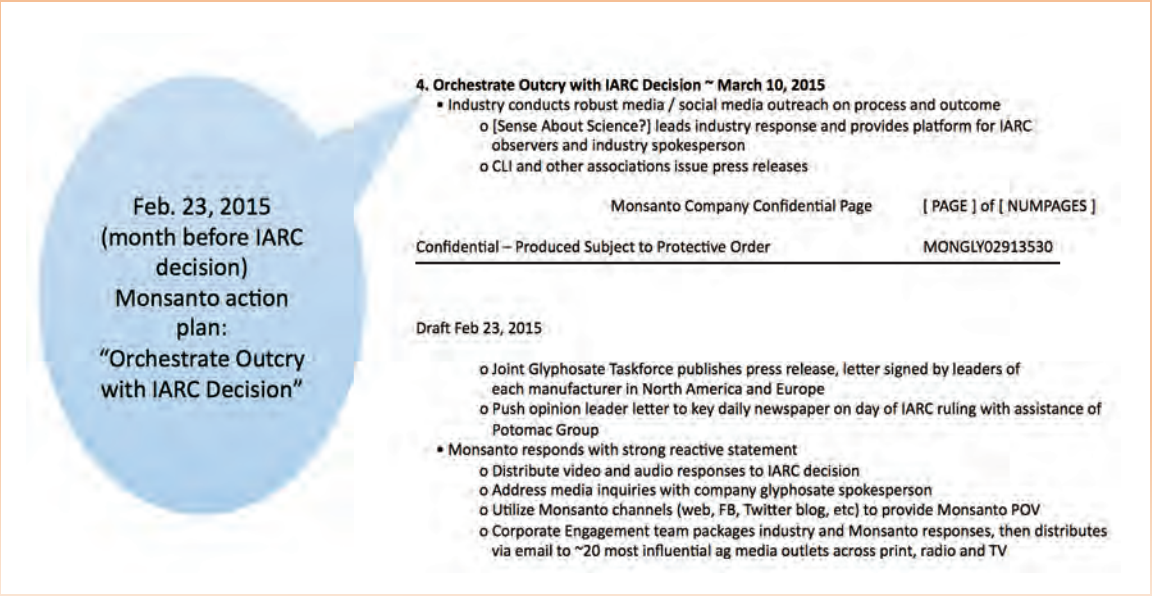
INFLUENCING POLICY

In addition to these scientific papers, we have evidence that Monsanto is engaged in directing policy briefs that are submitted to lawmakers or submitted to regulatory agencies, promoting product safety and Monsanto strategies. You see in the documents what they're saying to academics and others who are teaching and traveling around the world, again, appearing to be independent—"We'll send you the powerpoint; I'm editing your slides for you." They set up science outlets that, again, appear to be independent. They are pushing out messages to consumers, to medical professionals, and to others. They appear to be independent, but they are backed by the chemical industry—they are propaganda machines.

We see "front groups," and their connections, like Academics Review, Genetic Literacy Project, and Campaign for Accuracy in Public Health Research. Doesn't that sound lovely? There are Sense about Science and Biology Fortified. All of these say they're independent, but in Monsanto internal documents they're listed as "partners." When Monsanto wanted to attack IARC in their preparedness plan, they talk about how they're going to get these guys and others to help them to carry out their attack. They're listed as Tier 2 partners.

FIGURE 4:
[Monsanto] knew the science was there. They knew they were vulnerable. So they started laying out the plan of how to discredit IARC.

Source: Carey Gillam



Monsanto uses a number of false fronts:

- Websites, set up to promote Monsanto's agenda.
- Nonprofits established.
- Social media manipulation.
- PR experts working on behalf of Monsanto seek bloggers to post pro-industry articles that appear to be independent on consumer and health websites. . .to get things up on Web-MD and elsewhere.
- Journalistic manipulation through groups set up as a "science media" center that push pro-Monsanto sources and story ideas.

Academics Review is a good example because Monsanto's name is not on it anywhere. This was started presumably by a retiring University of Illinois professor, Bruce Chassy, PhD, to provide thoughtful and independent reviews and criticisms of scientific issues and look at journalists and scientists who may be whackos, and to alert the world to these whacko people. You can see in Monsanto's internal documents that it was their idea to set this up. They are talking to Dr. Chassy, sending him a check, first of all. Then they're saying: "From my perspective, the problem is one of expert engagement and that could be solved by paying experts to provide responses. The key will be keeping Monsanto in the background so as not to harm the credibility of the information." This website is still up there today. At least two articles were written about me on that website while I was at Reuters, and Tyrone Hayes, PhD has been written about. *The New York Times*' Eric Lipton "is a terrible reporter." This is what they do—they go after a whole lot of folks.

BLOCKING INDEPENDENT GOVERNMENT RESEARCH

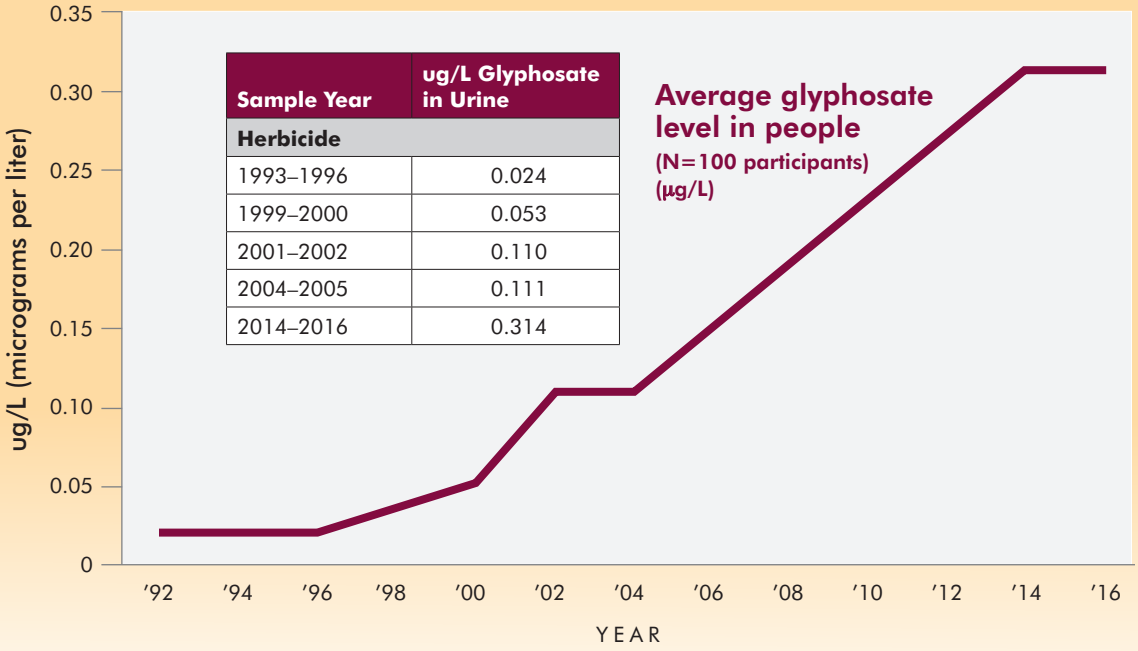
In 2015, the Department of Health and Human Services' Agency for Toxic Substances and Disease Registry (ATSDR), within the Centers for Disease Control and Prevention (CDC), wanted to take a look at glyphosate as well and had actually already started it. Monsanto got wind of it and did not want it to happen. You can see in their internal emails. They're saying, "We're trying to do everything we can to keep from having a domestic IARC occur with this group." "ATSDR is VERY conservative and IARC-like." Again, they knew. They know what the science says.

So they got in touch with at least three top EPA officials and said: "Yeah, we need some help with this. We need this to go away. We don't like this." Monsanto argued it was duplicative government resources.

So, EPA jumped. Within an hour of that first email going to EPA, Jim Jones, who was the top guy at EPA's Office of Pesticide Programs, is on the phone. Does the government work that fast for any of us, ever? They were ultimately successful. ATSDR pushed back a little bit a few times, saying, "We don't think it's duplicative. We think we're doing im-portant work." EPA keeps saying no. Monsanto's in there. Finally, ATSDR says, "Fine." We may still see something from ATSDR. They've said that they eventually will do something. But, it's 2018. That was 2015.

GENETIC ENGINEERING FOR PROFIT, NOT PRODUCTION

So, what has happened with all of this manipulation, this pushing, and these front groups? The use of glyphosate has surged, from about 40 million pounds a year on average in the mid-90s to about 300 million pounds used annually now. A big part of that, of course, was not only the propaganda, but the introduction of genetically engineered crops, which encouraged farmers to use these glyphosate products. And an important thing to note is that Monsanto's patent in the U.S. was expiring in the year 2000. When they introduced these crops, it wasn't about feeding the world. It wasn't about



Sample Year	ug/L Glyphosate in Urine
Herbicide	
1993–1996	0.024
1999–2000	0.053
2001–2002	0.110
2004–2005	0.111
2014–2016	0.314

FIGURE 5:
Human exposure climbs 500 percent since mid-1990s.

Source: University of California San Diego School of Medicinde (published in JAMA, October 2017)

helping farmers. It was about locking in market share because their patent was about to expire and they didn't want to lose that lucrative business. In an investor note that Monsanto sent out back in the early 2000s, right after their patent expired, they were reassuring investors. They said, "Look at this. Not only has use increased, but our share is really, really strong." So, it wasn't a secret when they introduced this. It was never about the farmer. It was about profit and market share.

PREDICTABLE SUPER WEEDS

Now we've had an explosion of super weeds, with all of this use of Roundup and glyphosate. I was really surprised when I started hearing about these "super weeds" and seeing them in the field. They are taller. You can't get rid of them in many cases if they get out of hand in your fields. So, farmers are fighting ever-more diligently—spraying two, three times more glyphosate and looking for other herbicides. Now we have dicamba and 2,4-D loaded on top of the glyphosate and crops that tolerate them. The number glyphosate resistant weeds worldwide has been increasing exponentially. (See Figure 6.)

GLYPHOSATE RESIDUES THROUGHOUT THE FOOD SUPPLY

Where has that left us? It's in our food because we're growing our food with glyphosate. I've done a number of *Freedom of Information Act* (FOIA) requests. FDA and USDA annually are charged with testing the nation's food supply for pesticide residues. They've been doing it for 30 some years. Both of them have been criticized sharply by the Government Accountability Office (GAO) because both of them routinely do not test for glyphosate. In decades of testing, they never looked for glyphosate, even though it is the most widely used chemical in the world. After they got hit by GAO, FDA said, "Fine. We'll test for glyphosate." I got wind of this in early 2016 and they confirmed to me that they would indeed start testing for glyphosate. That was February of 2016. They have still not publicly released any information, any data. I've had to get all this from FOIA requests. We found an FDA chemist in Atlanta testing honey samples, even organic honey, pulled from store shelves. Every single sample contained glyphosate residues–some at levels that were illegal in Europe. We don't have a legal limit in the U.S. All of it presumably is illegal. I was very concerned about this. FDA hadn't done anything. EPA hadn't done anything, and they didn't want to talk about it. The very same chemist also found glyphosate in oatmeal—baby oatmeal products that were found on store shelves.

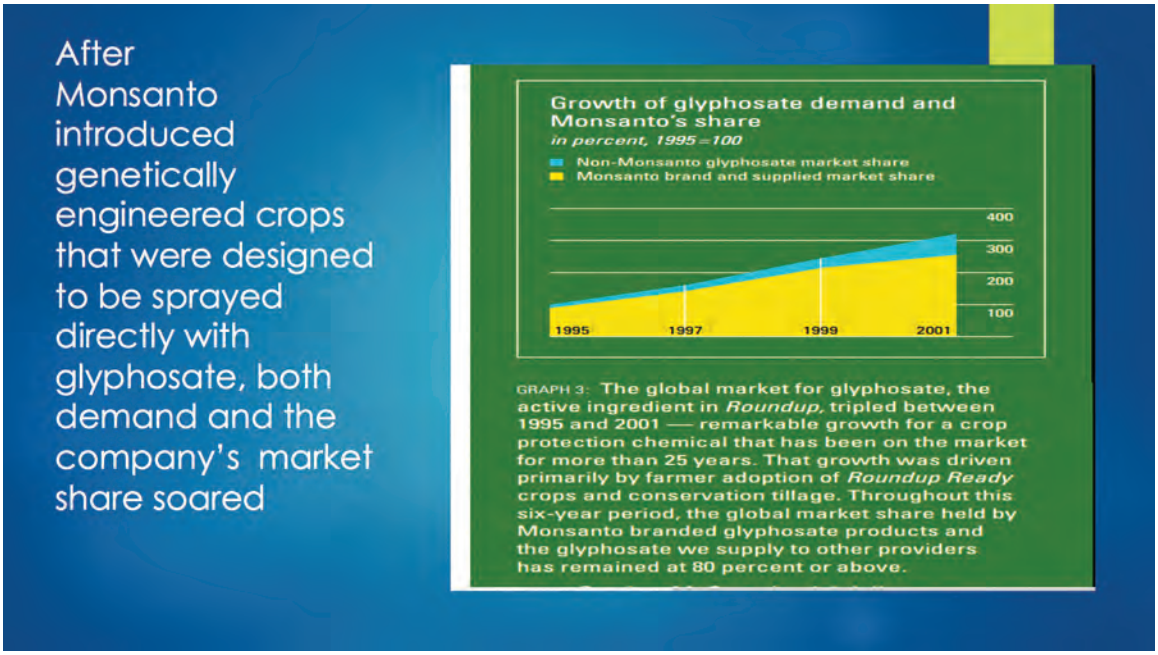
In another memo I just got from a FOIA request, a chemist from Arkansas was trying to find food without glyphosate residues. He tested wheat crackers, granola cereal, and cornmeal from home and found a fair amount in all of them. He says broccoli is the only thing he can find that doesn't have glyphosate in it.

USDA said a year ago, again in internal memos and reports, that it was going to start testing for glyphosate. But, by April 1, that plan had mysteriously disappeared, and they're not sure whether or when they are going to do it. It is worth noting that at this June 18 trial the lawyers from Monsanto have specifically asked the plaintiffs to be barred from mentioning anything about glyphosate residues in foods—at the same time that USDA and FDA are not reporting any glyphosate residues in foods. The University of California, San Diego School of Medicine has been tracking glyphosate levels in people for quite some time—at least since the mid-90s. Their data show that both the incidence of exposure and the glyphosate levels found in urine are up dramatically. It is in us. (See Figure 6.)

This is bigger than glyphosate. The 2015 data shows 85% of foods tested have pesticide residues in them. One sample

FIGURE 6:
Monsanto pushes exponential increase in glyphosate use and profits.

Source: Carey Gillam



of strawberries had more than 20 different pesticides. In the most recent data available from FDA's pesticide residue testing of about 6,000 food samples (51.2% of domestic food types), 43.2% contain pesticides and 80% of the fruits show the pesticide residues, 2% at illegal levels.

A NEUROTOXIC PESTICIDE INADEQUATELY REGULATED

Chlorpyrifos, marketed by Dow chemical. We all know, science knows, EPA scientists know, it causes neuro-developmental damage in children. It's the fourth most prevalent pesticide found now in our food supply, according to FDA, and EPA cannot vouch for any level as safe in food and water. We are not doing anything about it.

This is why I do this—because we have kids, we feed our kids, and our kids are eating this. Chlorpyrifos and these other pesticides are very damaging to our children in these key developmental times. The American Academy of Pediatrics is calling for greater protections from toxic exposures. I don't feel like we're getting there.

I want to share a quote from this paper I mentioned earlier by Dr. Birnbaum: "Existing U.S. regulations have not kept pace with our scientific advances showing that widely used chemicals cause serious health problems at levels previous assumed to be safe. The most vulnerable population, our children, face the highest risks." We should all pay attention to it. This paper drew the ire of the House Committee on Science, Space, and Technology chairman, Lamar Smith (R-TX), who called for Dr. Birnbaum to be investigated for writing this statement. Because how *dare* she advocate for public policy—which you're not supposed to do as a government scientist because she was calling for greater protection of public health. So she's in the hot seat.

We always have to quote Rachel Carson:

"If, having endured much, we have at least asserted our right to know, and if by knowing, we have concluded that we are being asked to take senseless and frightening risks, then we should no longer accept the counsel of those who tell us that we must fill our world with poisonous chemicals; we should look about and see what other course is open to us."

Whitewash is a book that Monsanto really doesn't want you to read. The agrichemical industry has gone after it quite heavily. The industry tells us not to worry. One of the reviews from Biology Fortified, a Monsanto partner, called the book hogwash. They say you shouldn't worry about pesticides in food. You shouldn't worry about it in your water. You shouldn't worry about pesticides in your body. There's no evidence that it's tied to cancer. They tell us not to worry. They're counting their profits and we're all getting cancer. So, I say, it's not a feel good story, but a story that has to be told. Thanks for letting me tell it.

Carey Gillam is a veteran journalist, researcher and writer with more than 25 years experience in the news industry covering corporate America. Since 1998, Gillam's work has focused on digging into the big business of food and agriculture. As a former senior correspondent for Reuters' international news service, and current research director of the consumer group U.S. Right to Know, Ms. Gillam specializes in finding the story behind the spin; uncovering both the risks and rewards of the evolving new age of agriculture. Ms. Gillam's areas of expertise include biotech crop technology, agrichemicals and pesticide product development, and the environmental impacts of American food production. She has been recognized as one of the top journalists in the country covering these issues. Ms. Gillam can be reached at carey@careygillam.com.

Pesticide Use Harming Key Species Ripples through the Ecosystem

Regulatory deficiencies cause trophic cascades that threaten species survival

Boulder Creek, Boulder, Colorado

DREW TOHER

Despite a growing body of scientific literature, complex, ecosystem-wide effects of synthetic pesticides are not considered by the U.S. Environmental Protection Agency (EPA). Beyond direct toxicity, pesticides can significantly reduce, change the behavior of, or destroy populations of plants and animals. These effects can ripple up and down food chains, causing what is known as a trophic cascade. A trophic cascade is one easily-understood example of ecosystem-mediated pesticide effects.

In determining legal pesticide use patterns that protect ecosystems (the complex web of organisms in nature) EPA requires a set of tests intended to measure both acute and chronic effects. An ecological risk assessment considers the lethal concentration at which 50% of a population of a given species will die (LC50), and the chronic impacts associated with environmental exposure.

The concept of a trophic cascade is well illustrated by the local extinction and subsequent repopulation of wolves in Yellowstone National Park (YNP). The loss of wolves from YNP in the 1930s due to overhunting led populations of their primary prey, elk, to explode. Without a check on their growth, elk browsed heavily on aspen, cottonwood, and willow. Denuded willow stands stunted populations of beavers that rely on the trees to make it through the winter. When wolves were reintroduced in the mid-1990s, beaver populations began to improve. Elk still had other predators—bears, cougars, coyotes—but only wolves kept elk skittish enough to avoid browsing willow on streambanks. This led to a resurgent willow population, providing new habitat for songbirds. Beaver dams further altered the landscape by reducing runoff and stabilizing the water table, and both worked in tandem to provide cool, deep, shaded water for native fish.

When a predator higher up on the food chain is eliminated, that predator's prey is released from predation, often causing a trophic cascade that throws the ecosystem out of balance. It is not always the top-level predator that creates a trophic cascade. The loss or reduction of populations at any trophic level—including amphibians, insects, or plants—can result in changes that are difficult to perceive, but nonetheless equally damaging to the stability and long-term health of an ecosystem. Salient research on the disruptive, cascading effects that pesticides have at the ecosystem level must lead regulators to a broader consideration of the indirect impacts caused by the introduction of these chemicals into complex living systems.

PESTICIDE-INDUCED TROPHIC CASCADES LEAD TO DISEASE OUTBREAKS

Pesticides create disruptions in ecosystems because of the interplay between toxicity and indirect impacts. But it is not always possible to observe these effects in the wild, as researchers did in YNP. To study how food webs respond to human-made stressors like pesticides, scientists use mesocosms—small structures containing various plants and animals intended to mimic the natural environment.

In many cases, researchers will use mesocosms to investigate observations in the field, as Rohr et al. (2008) did when studying the impacts of the herbicide atrazine on the health of northern leopard frogs, a once-abundant species in the U.S. that is now in decline. In the field, atrazine was found to be associated with an increase in the number of parasitic flatworms in leopard frog habitat. However, the ecological process behind this phenomenon was murky.

Figure 1: **Yellowstone's Trophic Cascade**

TROPHIC CASCADE: No wolves leads to more elk, which eat more willow, which eliminates food sources for beavers, shaded areas needed for native fish, and habitat for songbirds.

STABLE ECOSYSTEM: More wolves leads to fewer elk browsing streambanks, which increases the willow population, subsequently providing more food for beavers, and habitat for songbirds and native fish.

Flatworms have a complex life history that brings them through several hosts in the food web, with the endpoint of infecting a predator, which will release its eggs into the water when defecating. Aquatic flatworm eggs hatch into free-swimming larvae, and further develop by using snails as an intermediate host. After infecting snails, the larvae can then infect tadpoles. Adult frogs infected with flatworm larvae as tadpoles exhibit limb malformations, kidney damage, and complete exhaustion, making them easy prey for predators. Field observations of higher levels of periphyton (attached algae), a major food source for snails, in atrazine-contaminated waters led Rohr et al. (2008) to hypothesize that atrazine was increasing snail abundance. To verify this hypothesis, researchers created a series of 1,100 liter mesocosm tanks containing, among other flora and fauna, phytoplankton (free floating algae), periphyton, snails, and leopard frog tadpoles. (The mesocosm also contained zooplankton, beetles, water bugs, and dragonfly larvae, however impacts to these species as a result of atrazine exposure were not analyzed by researchers.) Some tanks were dosed with real-world levels of atrazine, while others acted as a control. Snail abundance increased significantly in the atrazine-contaminated tank, over four times compared to an unexposed mesocosm. This was indicative of a trophic cascade, which took the following route: atrazine killed off most free floating phytoplankton algae, leading to increased water clarity and light penetration, which jump-started the production of periphyton, which subsequently increased the population of snails that could carry flatworm parasites. Not only did atrazine increase the parasite load, it also had the direct effect of making frogs more vulnerable to infection through immunosuppression.

The effects of this trophic cascade are not limited to sensitive amphibian species. Humans are also at risk of infection from parasitic flatworm larvae, particularly in intensive agricultural areas in developing countries. Using a mesocosm experiment that analyzed both the aforementioned species as well as snail predators (water bugs, crayfish), Halstead et al. (2017) investigated the effects of environmentally relevant concentrations of both atrazine and the insecticide chlorpyrifos on the transmission of schistosomiasis, a human disease caused by flatworm parasites. Schistosomiasis can result in rashes, itchy skin, fever, chills, cough, headache, belly pain, joint pain, muscle aches, and in severe cases impair organ or nervous systems.

In mesocosms tested, atrazine created a trophic cascade similar to that observed by Rohr et al. (2008), reducing free-floating algae and increasing attached algae, leading to higher snail populations due to increased food availability. When chlorpyrifos, often applied to agricultural fields alongside atrazine, was added to the mesocosm, snail predators declined significantly, releasing snails from predation that would otherwise suppress their population.

Halstead et al. (2017) incorporated these data into epidemiological models to determine the risk of disease transmission in real world scenarios. It was determined that while atrazine caused a 28% increase in schistosomiasis transmission risk by indirectly increasing snail populations, the loss of crayfish and water bug predators were catastrophic for human health, leading to a 10-fold expected increase in parasitic infection. On the other hand, in healthy mesocosms unexposed to

either pesticide, predator populations were able to adequately maintain snail numbers below thresholds for disease transmission.

While regulators have acknowledged sublethal effects of atrazine on amphibians, this intricate process whereby atrazine use increases debilitating parasitism in amphibians is not taken into account. Nor is there any mechanism through which EPA considers the potential for multiple pesticides to trigger a trophic cascade that magnifies the risk of human disease transmission. A wealth of independent mesocosm research, however, is providing a road map for regulators to begin evaluating these complex interactions.

TROPHIC CASCADES IN AQUATIC ENVIRONMENTS UNDERSCORE ECOSYSTEM COMPLEXITY

Pesticides can make their way into aquatic ecosystems through run-off from a single application (such as a "pulse" from an agricultural area), or in low doses over the course of several weeks (as is common in mosquito control efforts). Relyea and Dieks (2008) hypothesized that differences in application timing, amount, and frequency would lead to different impacts on a pond ecosystem. To test this idea, researchers created a series of mesocosm tanks comprised of phytoplankton, periphyton, zooplankton (herbivorous phytoplankton algae eaters), and wood frog and leopard frog tadpoles. Some tanks received one large single dose of the organophosphate insecticide malathion, while others had the pesticide applied at low amounts over seven weeks.

In both instances, malathion's impact on zooplankton caused a trophic cascade. By depressing the zooplankton population, phytoplankton flourished. The increase in free-floating algae clouded water, decreased light penetration, and led to reduced periphyton growth. Decreases in periphyton algae, the primary food source for tadpoles, retarded growth and development in leopard frogs, which prevented many from metamorphosing before the vernal pool in which they resided dried up (though wood frogs were generally unaffected). While zooplankton in the single-application mesocosm eventually experienced a population rebound, it took nearly a month and a half before this occurred. Overall, frogs in single-application mesocosms fared slightly better than those in chronically exposed tanks, which experienced an ongoing state of disruption that never permitted zooplankton populations to bounce back.

Hua and Relyea (2012) sought to find out whether pond ecosystems from different regions respond the same way to malathion contamination. This was tested by creating mesocosms with different food web assemblages—one from the east coast and one from the west coast. Though both food webs still contained zooplankton and algae, west coast tanks included northwestern salamander and cascade frog tadpoles, and east coast tanks contained spotted salamanders and wood frogs. As hypothesized, both communities produced similar trophic cascades in response to malathion input. However, while malathion's effect on zooplankton reduced the growth and development of their salamander predators, both frog species fared well. The researchers indicate this was likely because, when compared to leopard frogs tested by Relyea and Dieks (2008), cascade frogs and wood frogs are quicker to metamorphosize, and able to complete their transition to adulthood before the trophic cascade limited their food supply.

The sum of these studies have important implications for regulators. Beyond direct toxicity to a single species, the timing and frequency of a pesticide application can determine whether an ecosystem may be able to recover from a trophic cascade event. Further, even when generalizations can be made about trophic cascades, effects on different species of the same animal can vary based upon differences in physiology and life history. This additional complexity underlines the fact that there is much more to understand about the broader effects of pesticides on the environment.

PESTICIDE HAZARDS CAN AFFECT THE TERRESTRIAL ENVIRONMENT, ECOSYSTEM SERVICES

Pesticide-induced trophic cascades can affect a range of aquatic ecosystems, and these impacts can translate to terrestrial food webs. In addition to still-water ponds, researchers

Issues with EPA's Current Ecological Risk Assessment

Under 40 CFR 158.630, EPA is required to evaluate how pesticide use patterns impact a range of non-target species. Risk assessments are conducted on test organisms that represent a class of animal, including birds, mammals, aquatic organisms, such as fish and invertebrates, and insect pollinators. The agency generally assumes that the response of these test species will be indicative of how the class responds.

Under EPA Guidelines for Ecological Risk Assessment issued in 1998, the agency acknowledges the potential for "cascading adverse effects" as a result of pesticides' indirect effects. However, when these evaluations are conducted, they are usually simplified in a way that considers how a single chemical's impact on one sensitive species may cause a less sensitive species to decline.

EPA's evaluation generally does not take into account the real-world complexities that are required for a full analysis, including multiple trophic levels, longer exposure periods, behavioral and developmental factors, pesticide mixtures, species resistance, and "pass-through" effects.

Strengthening regular integration of complex ecological assessments into EPA's review process may offer more information, however risk assessments do not take into account all potential adverse effects that could occur after the release of a chemical into an ecosystem, ultimately necessitating the adoption of alternative practices that do not require pesticide use.

can also craft mesocosms to mimic a runoff event of a pesticide into a stream ecosystem. In a study conducted by Rodgers et al. (2016), the synthetic pyrethroid insecticide bifenthrin created a trophic cascade that rippled both up and down the food chain. Bifenthrin caused significant downward population pressure on larval macroinvertebrates (such as mayflies, stoneflies, and caddisflies) at concentrations lower than previously recorded in literature. The loss of these periphyton-eating species initiated a trophic cascade from the top-down, causing a bloom in attached algae. Bifenthrin's impact on the endocrine (hormonal) system of macroinvertebrates also caused those that remained to speed up their time to metamorphosis, emerging smaller and earlier than usual. This can lead to bottom-up trophic effects on terrestrial insects, amphibians, reptiles, and birds that rely on a healthy population of aquatic invertebrates as a food source. Extrapolating the data gained from the mesocosm experiment and comparing it to the U.S. Geological Survey's Midwest Stream Quality Assessment of pesticide contamination, Rodgers et al. (2016) determined that 40% of streams are at risk of altered food web dynamics, and 7% are at risk of a trophic cascade leading to an algae bloom.

In a rare instance for trophic cascade science, Thompson et al. (2016) investigated what happens in the real world when a pesticide contaminates a stream environment. After a significant chlorpyrifos spill into a UK stream, researchers set up a comparison control site to evaluate changes in aquatic communities at the affected site. The contaminated stream underwent significant trophic reshuffling, precipitated by population declines of important macroinvertebrates and detritivores. The loss of these animals resulted in less food for species like trout higher on the food chain, which researchers indicated can then flow upwards to affect other predator species, such as birds, otters, and other mammals. Down the food chain, although bacteria and other microbes proliferated in an attempt to make up the work, the loss of amphipods and other detritivores led to lower rates of decomposition overall, indicating a potentially significant impact on nutrient cycling, a critical ecosystem service provided by natural environments.

In both still and fast-moving aquatic environments, pesticides act powerfully on the foundational levels of the food web. Although algae blooms are usually considered the result of excess nutrient input, it could also be the case that a recent insecticide application eliminated all of the herbivorous grazing macroinvertebrates. Likewise, declines in threatened predators like otters could be related to impacts two steps down the food chain, if the fish on which they rely have declined due to pesticide-induced reductions in their prey.

RESISTANCE MEASURES

Given clarity that pesticides lead to trophic cascades, researchers have begun to investigate whether there may be ways to buffer their deleterious impact on the environment.

Signage along Boulder Creek, Boulder, Colorado

Figure 2: **Atrazine-Initiated Trophic Cascade Increases Parasite Infection Rate in Frogs**

STABLE ECOSYSTEM (no pesticide): In a stable, uncontaminated ecosystem, phytoplankton blocks sunlight so that periphyton does not grow out of control. This maintains low populations of snails that transmit parasites to frogs, and allows frog populations to remain stable.

TROPHIC CASCADE (atrazine contaminated): The influx of atrazine into the ecosystem kills off free floating algae, which increases populations of attached algae, providing more food for snails and increasing their population, and the parasite load they can carry, causing more frogs to become infected, reducing their population.

Boone and Sullivan (2012) found that adding leaf litter to a mesocosm, set up similar to Relyea and Dieks (2008) but contaminated with the insecticide carbaryl (rather than malathion), increased the survival of green frog tadpoles. When the trophic cascade occurred, the nutrients in the leaf litter facilitated the growth of periphyton, which increased food resources and hastened the metamorphosis of tadpoles into frogs. Similarly, Brogan and Relyea (2015) found that macrophytes (submerged aquatic plants) had the ability to mitigate trophic cascades caused by malathion contamination by shielding the zooplankton population. According to researchers, this buffer effect occurred because macrophytes take up carbon dioxide, which reduces carbonic acid in the water and thus raises pH, which subsequently results in faster degradation of malathion. Also, through nutrient competition and natural allopathy, macrophytes can suppress the growth of light-reducing phytoplankton algae even if zooplankton decline in the habitat.

Nature may even be taking steps to slow down trophic cascades without human intervention. Randall and Relyea (2014) found that in agricultural areas, high percentages of zooplankton populations are resistant to the insecticide chlorpyrifos. By inserting these resistant zooplankton into a mesocosm, Bendis and Relyea (2016A) found that they had the ability to mitigate trophic cascades by maintaining their numbers and preventing phytoplankton blooms, leading to increased survivorship of leopard frogs in a mesocosm. Bendis and Relyea (2016B) also found that this pesticide insensitivity translates to other insecticides with similar modes of action. While resistant zooplankton were unaffected by other nerve inhibitors like carbaryl and malathion, exposure to another class of insecticides, synthetic pyrethroids, still led to a trophic cascade ending with a phytoplankton bloom.

These studies provide some indication that ecosystems can adapt to the effects of trophic cascades, but in no way do they nullify the original contamination caused by pesticide use. In fact, these data underscore the need to adequately evaluate the complexity of pesticide impacts on the environment. Regulators can begin to get a handle on these impacts by including mesocosm studies in pesticide registration requirements. As the next section reveals, this research should also be paired with agricultural case-studies evaluating the overall effectiveness of pesticide use.

TROPHIC CASCADES IN AGRICULTURE CANCEL OUT ANY PESTICIDE "BENEFITS"

In more simplified ecosystems, such as those seen in agricultural fields, changes in trophic structure can be particularly pronounced. Mesleard et al. (2005) found that the insecticide fipronil, used to control midge pests in conventional rice fields, causes a trophic cascade that reduces the nutritional value of the area for waterfowl. Comparing a chemical-intensive rice field to one managed organically, the trophic cascade ultimately neutralized the efficacy of synthetic pesticide use in the first place.

Direct toxicity from fipronil reduced the number of invertebrate predators in chemical-intensive rice fields. This led to a trophic cascade that allowed herbivorous animals to flourish. On the surface, organic and chemically-managed rice fields both contained the same amount of invertebrate biomass. However, in chemical-intensive fields, this biomass was primarily in the form of gastropods (snails and slugs). When researchers surveyed the fields in late summer, only 12% of the invertebrate community were predators, while in organic fields that proportion was 70%. Slugs and snails are not a major food source for the most common waterfowl in the region studied, the heron, making organic plots a more valuable source of sustenance. As evidenced by Rohr et al. (2008), if flatworm populations are present they may also be leading to higher disease loads in amphibians and other aquatic wildlife. Critically, researchers identified relatively equal numbers of midge pests between organic and conventional fields, leading the authors to deem fipronil use "inefficient," as the trophic cascade that occurred in conventional fields depressed natural predation of midge pests by its macro-invertebrate predators.

Many researchers have made similar determinations about efficacy after looking into the trophic impacts of systemic pesticides like fipronil, and the neonicotinoid class of insecticides. These chemicals are increasingly employed to address outbreaks of invasive species, potentially creating more problems than they solve. Analyzing case studies aimed at managing the Asian longhorned beetle and emerald ash borer in Maryland and New York City's Central Park, Szczpaniec et al. (2011) found that the use of the neonicotinoid imidacloprid indirectly causes a predator-prey reversal. Mites feeding on neonicotinoid-contaminated leaves accumulated the insecticide in their bodies, but did not die. Because of this, the mites successfully killed their insect predators, a result of a "pass-through" effect. Not only did they reverse the predator-prey relationship, laboratory tests also found that spider mites that ate these contaminated leaves laid more eggs, which researchers attributed to a physiological change in the infested trees after imidacloprid application. Prior research by Raupp et al. (2004) had also identified higher rates of spider mite infestation when using imidacloprid to treat for hemlock wooly aldegid.

The "pass-through" phenomenon in trophic cascades is best exemplified in the study conducted by Douglas et al. (2014). Field crops, such as soybeans, will often be coated with a variety of pesticides, with those in the neonicotinoid class the most frequent. The intent of these seed treatments is to reduce risk of crop damage to young seedlings, however Douglas et al. (2014) found this practice to be counterproductive.

Starting in the lab, researchers provided slugs, a primary pest in soybean fields, neonicotinoid-treated seedlings to eat. The slugs experienced no adverse effect on survival, behavior, or physiology as a result of eating the contaminated seedlings. Researchers then placed these slugs in an enclosure with a ground beetle predator. Beetles that ate unexposed slugs fared well, but those that ate slugs that had dined on neonicotinoid-treated seedlings experienced impairment ranging from reduced motor function to paralysis or death. This process also translated to field conditions. During the first month after seed treatment in a soybean field, slug predation was reduced by 33%, slug activity increased by nearly 70%, and, over the course of the season, soybean yields were down 19%. Contrary to claims by the pesticide industry that seed treatments are "targeted" and do not impact non-target organisms, this study reveals an enormous flaw in the pesticide review process.

In a follow-up meta-analysis on the impacts of neonicotinoid seed treatments, Douglas and Tooker (2016) determined that natural predators were reduced by 16% in agricultural fields where these seeds were used, comparable to what would occur if their use was replaced with synthetic pyrethroid insecticides.

HOW REGULATORS CAN DO BETTER

The studies analyzed only begin to touch on the multitude of ways that pesticides can upset and imbalance ecosystem health and stability. Findings related to increased risk of disease transmission, dangers to declining species, algae blooms, the loss of ecosystem services like nutrient cycling, and importantly, ineffective pest management, establish the critical need for EPA to consistently assess ecosystem level trophic effects as part of the pesticide registration process. In the absence of a truly precautionary system where independent science is adequately considered by regulators, and pesticides are removed from the market when found to cause trophic cascades or other ecosystem disruption, the agency must develop a "No Observed Adverse Effect Level" for ecosystems, in addition to individual species. The agency must require manufacturers to conduct mesocosm experiments on typical aquatic communities. Pesticides placed on the market should be continuously monitored for their ability to create "pass-through" impacts in target pests that lead to trophic cascades. Case studies in agricultural fields are also needed to confirm the efficacy of pesticide use in the first place. When chemicals are found to be associated with ecosystem level effects, they should be immediately suspended until research can determine whether there is a threshold at which no adverse effects on ecosystems are seen. If regulators begin to consider the complex, ecosystem-wide impacts of pesticide contamination in our environment, we can get a true assessment of pesticides' adverse effects and prevent future disruptions through the adoption of alternative practices.

A fully cited version of this article is available at bp-dc.org/ecoeffects.

Maintaining Public Trust in the Organic Label

PUBLIC PARTICIPATION CRITICAL TO HOLDING THE ORGANIC BOARD AND USDA ACCOUNTABLE TO THE LAW

With a strong contingent of organic advocates at the April meeting of the National Organic Standards Board (NOSB) meeting in Tucson, Arizona, attention focused on key issues of organic integrity. Decisions by the U.S. Department of Agriculture's (USDA) National Organic Program (NOP) have challenged long-standing process of the board and called into question public trust in the USDA organic label. Advocates believe that the *Organic Foods Production Act (OFPA)* is exceptionally strong and seek to hold NOP accountable to the law.

Maintaining Rigorous Compliance with the Law

With high legal standards that set organic apart from chemical-intensive agriculture, both in practices and materials that are permitted, the board and NOP continue to have some key unfinished business that needs to be addressed. As a result, several commenters turned their attention to issues that were not on the agenda, stating that the NOSB has a duty to consider a range of critical issues, including contamination of organic crops and products from genetically engineered material, "inert" (not disclosed nor fully tested) ingredients used in substances permitted in organic production, contaminated fertility inputs, and adequate enforcement to prevent fraud. How and when these issues get addressed will determine the public's trust in the organic label.

Addressing Fraud

A panel composed of growers and certifiers kicked off an NOSB and public discussion of fraudulent imports. Panelists pointed out—as had a number of public commenters—that fraud in organic is not restricted to imports. They said that large instances of fraudulent imports were discovered not by USDA, but by other organizations. The same is true for domestic fraud—in which products are certified organic, while not meeting requirements for pasture and outdoor access for animals. Advocates maintain that on-the-ground investigations are necessary to combat fraud, even with increased documentation to track production practices.

Protecting Native Lands

In the lead up to the meeting, a series of discussion documents addressed the issue of the need to eliminate the incentive, created unintentionally to convert native lands to organic production. Unfortunately, the requirement in OFPA to avoid the use of prohibited substances for three years before land can be certified organic produces an unintended incentive to convert important native habitat to organic farms. The NOSB passed by a vote of 11-1 (with one absent) the proposal to define native ecosystems and prohibit certification of that land for ten years after conversion to farmland. Public support will be needed to ensure that NOP implements the recommendation.

Training Organic Inspectors

The NOSB passed unanimously a proposal asking NOP to "develop minimum qualifications and training, and continuing education guidelines to ensure a professional and competent inspector pool to meet the demands of ever-evolving and complex organic supply chains," and defining "emergency" to restrict the situations in which parasiticides may be used in organic livestock.

Evaluating Allowed Substances in Production

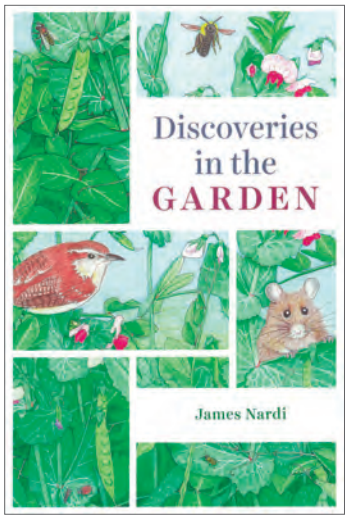
With regard to materials used in organic production and handling, the NOSB recommended adding two materials to the National List of allowed synthetic substances in crop production—polyoxin D zinc salt as a fungicide (11 yes, 1 no, 1 abstain) and sulfur as slug and snail bait (unanimous). The board turned down a petition for glycolic acid as a teat dip by a vote of 7 yes to 6 no—the two-thirds vote required to list was not achieved. The board heard comments on materials that are due to sunset in 2020, and will vote on those materials at the October meeting.

NOSB Composition

The 15-member board, consisting of four farmers, three environmentalists, three consumers, two food processors, one retailer, one scientist, and one certifying agent, votes to allow or prohibit substances and practices in certified organic food and farming. The board was short two members, because NOP did not replace an open slot for a conservationist and due to the resignation of the handler representative. At the beginning of the meeting, Greg Ibach, Under Secretary of USDA Marketing and Regulatory Programs, announced the appointment to the conservationist position James Greenwood, PhD, an organic avocado grower and handler who serves on the faculty of the School of Public Health and the Center for Public Health of the University of California at Los Angeles, and to the handling position Eric Swartz, CEO of the California-based United Vegetable Growers Cooperative.

Reviewed by Terry Shistar, PhD

Gardening in Partnership with Nature



Discoveries in the Garden and Life in the Soil—A Guide for Naturalists and Gardeners,
James Nardi, PhD
The University of Chicago Press
2018, 288 pages

Life in the Soil: A Guide for Naturalists and Gardeners
James Nardi, PhD
The University of Chicago Press
2007, 336 pages

Dr. Nardi's newest book is *Discoveries in the Garden*. It is arranged as a textbook for a field biologist whose specialty is the garden. But its arrangement may be deceptive if "textbook" means dry and uninteresting, which this is not. *Discoveries in the Garden* leads the reader through topics from seeds to plant parts to plant physiology to ecology—all following a trail of scientific discovery. It is a hands-on learning experience that invites us to observe, describe, and hypothesize as we investigate each topic.

Each chapter is introduced by a drawing that illustrates the ecological context for its topic. This ecological context is one thing that distinguishes these books. Unlike other field guides, *Life in the Soil* examines each soil organism in relation to others and in relation to human farmers and gardeners. In reading it, we gain an understanding of the importance of soil biology to farmers and gardeners. Unlike other botany texts, *Discoveries in the Garden* relates plant biology to the soil, insects, and other consumers, and the aboveground and belowground food webs that shape plants and their communities.

As we follow Dr. Nardi's path from seeds to buds and stems, flowers and fruits, we see the interplay of plant hormones. Other lessons in plant chemistry come from observing plant colors and odors. These lead to hypotheses about photosynthesis and interactions among plants (and between plants and other organisms.)

In contrast to prevailing opinions of weeds, *Discoveries in the Garden* values the "wisdom of the weeds"—not only for what we can learn from them, but also for their contributions, including protecting the soil from erosion; conserving nutrients; building soil structure, organic matter, and mineral content; supporting soil biology; sequestering carbon; and encouraging biodiversity. In addition, as the book suggests, observing weeds can teach us about plant strategies for growth, reproduction, and competition.

Dr. Nardi is not the first scientist to learn from his garden. Charles Darwin made observations and conducted experiments in his own garden that taught him about birds, earthworms, plant movements, pollinators, and the interaction of different species. Darwin's theory of evolution was informed by observations in his garden, and *Discoveries in the Garden* leads us in Darwin's footprints.

Life in the Soil is divided into three parts. The first is an introduction to soil ecology—its mineral and organic components, how soil organisms adapted to their environment, and the relationships among members of the soil community. The last applies knowledge of soil ecology to the soils of farms and gardens. The heart of the book, however, is in the middle part, in which Dr. Nardi introduces us to those creatures who live in the soil—microbes, invertebrates, and vertebrates. Each entry describes a species, genus, or family of organisms—how each makes a living in the soil, relates to other soil organisms, and relates to human gardeners or farmers. Each entry contains a fact box with vital statistics, including taxonomic classification, size, and role in the food web. An interesting characteristic he reports is "impact on gardens," which may be ally, adversary, or neither. Those who are accustomed to viewing microbes and insects as enemies will be surprised to see how many allies we have among those groups.

James Nardi, PhD teaches at the University of Illinois at Urbana-Champaign and "gardens with the help of innumerable soil creatures." If his books are any indication, he is a great teacher.

Discoveries in the Garden *relates plant biology to the soil, insects, and other consumers, and the aboveground and belowground food webs that shape plants and their communities.*

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