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

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Pesticides *and* You

Scientific Findings Support Replacing Poisons with Precaution

Medical doctor and epidemiologist calls for avoiding pesticide use and adoption of the precautionary principle.

FEATURES

Health and Environmental Protection Urgently Requires Precaution

This issue of *Pesticides and You* makes the case for the adoption of the precautionary principle and related law from a medical, policy, and experiential perspective. The call to transform federal and state laws governing pesticide use restrictions is explained by a medical doctor who has studied patterns of environmentally induced diseases through epidemiology, lawmakers in the European Union who, as part of a joint commission, evaluated over several years the current deficiencies in pesticide restrictions, and examples of specific failures to mitigate the hazards of specific pesticides. As we have said so often on these pages, the pesticide threat is real, but so are the solutions. To make the necessary changes in law we must elevate our call for change.

A Call to Action

This is the time to call for urgent action to transform our nation's pesticides law, and state laws that mimic it, as part of a larger movement to transform a pollution-based economic system that drives us toward crises, despite the availability of sustainable and regenerative strategies that are right in front of us. Current law assumes the need for pesticides despite the evidence to the contrary and the robust scientific literature that documents adverse effects, and a high degree of risk uncertainty associated with the complex chemical interactions (from mixtures) that are not studied or evaluated. Current law ignores whole systems—the interrelationship of organisms in the ecosystem, the power and balance of nature, and the nonrenewable fossil fuels and natural gas used to manufacturer pesticides.

In this issue, we review the most recent meta-study of catastrophic declines in insect populations. The majority of studies identify chemical-intensive agriculture as driving this unsustainable decline.

A Demand for Transformation

All of this is occurring despite the availability of alternatives that are viable, cost effective, and job-creating. In fact, the solutions are good for the economy, but do not serve the interests of chemical companies wanting to maintain current chemical dependency in pest control. People do increasingly understand the insensitivity to public health and environmental protection of large corporations that are not invested in a sustainable future, but capitalize on approaches that keep society on the pesticide treadmill. More than ever, people understand that the laws and government regulators are not embracing the standards, or do not have the mandate and authorities, necessary to protect health and the environment.

In this issue, we outline the specific failures of current federal and state pesticide law, which feeds the syndrome of chemical dependence without attention to the value of the ecosystems where the toxic chemicals are used.

We Need Specific Model Language for a Sustainable Future

We only need look to the federal organic law for a model approach to regulating toxics and replacing them with regenerative strategies. Back in 1990 when the legislation was adopted, the values and principles in that law were not viewed as a threat to those profiting from the pesticide treadmill. They never could imagine that the law's standards would enable the growth of a $50 billion and growing organic sector.

Our experience with organic has taught us that there are processes and procedures that must become central to regulating toxics in land and building management. Critical to the adoption of a new approach to regulating toxics is an understanding of the deficiencies in the risk mitigation approach in current pesticide law. A regenerative organic approach, which must be required, will appreciate and respect complex biological systems in which synthetic chemicals are used. In this process, we must consider the ecosystems that are the environment and the ecosystem within our bodies.

We must move urgently to a systems approach in our regulatory standards governing toxics. We have documented the foundational justification for this in previous pieces published in *Pesticides and You*—"Good Health Harmed by a Cascade of Complex Pesticide Effects" (Winter 2018-2019) and "Thinking Holistically When Making Land Management Decisions" (Spring 2018). No longer can reductionist standards allow one dimensional assessments that ignore the real world complexities of toxic chemical use. Rather, our consideration of biodiversity must extend from the soil microbiota to the gut microbiome. We must determine that there are no adverse effects from manufacture, use, to disposal, or from cradle-to-grave. And, with a needs assessment, we must determine that any material allowed to be used is necessary, or essential. With respect for the importance of science and to incentivize continuous improvement, all synthetic materials must come off an allowed list on a five-year cycle, and only be relisted with a 2/3's vote of a stakeholder board without conflict of interest. If this sounds impossible, it is currently being done under the *Organic Foods Production Act* and it is precautionary.

Now is our time to take action.

Jay Feldman,
executive director of
Beyond Pesticides

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DEPARTMENTS

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

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What is the Truth about Organic Pesticides?

I try to buy and eat organic, but I'm a bit confused by articles on the web that say that organic also uses pesticides that are more toxic than conventionally grown foods. Is this fake news? If not, what is Beyond Pesticides reply to this? Why should I still buy organic if they also use toxic pesticides?

Charles, Buford, GA

Hi Charles,

Thanks for your question. We appreciate the opportunity to dispel some of these concerns, as there does appear to be a concerted effort online and in some media to tarnish the organic label and present a "both sides" argument that organic is no better, safer, healthier, or environmentally friendly than food grown conventionally in chemical-intensive agriculture. It is not true that organic uses the highly toxic substances used in conventional agriculture. In fact, the review process for allowed materials is much more rigorous in its protection of human health and biodiversity, resulting in the only real option we have to preserve life on this planet.

Critics often try to disparage organic by pointing out that organic allows pesticide use. Technically, this is true, but the details really do matter. Any materials approved for use in organic production are evaluated for three important criteria: i) no adverse impact on humans and the environment; ii) essential (necessary) in organic production, and; iii) compatible and consistent with an organic systems approach defined by the organic law. An independent stakeholder board of 15 experts from a range of perspectives, including organic farmers, environmentalists, consumers, a retailer, a scientist, and a certifying agent together approve or disapprove materials for use in organic using the aforementioned criteria. This review process utilizes a range of data—from government agencies, independent peer-reviewed science, and public interest groups—and is informed by a Technical Evaluation Report. And because a 2/3's majority is required to add a material to the allowed list in organic production, this process is intended to ensure that the allowed synthetic inputs are innocuous, from their production through use and disposal.

Contrast that with the Environmental Protection Agency's (EPA) process for registering pesticides. Up front, the agency assumes that whatever product a pesticide manufacturer wants to register provides a public or user benefit. This is an assumed economic benefit. EPA then conducts an assessment to weigh those benefits against the risks a chemical poses to public health and the environment. In setting allowed residues (tolerances) on food, the health-based standard of food safety law also assumes pesticide benefits. And there are a number of catches here that tilt the assessment in favor of the pesticide industry. EPA protocol relies on the pesticide manufacturer to produce and submit all the safety test data necessary for the registration and labeling of pesticide products, and permits the industry to retain much of the information on product

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ingredients as confidential business information (CBI). The agency rarely considers scientific data from independent peer-reviewed scientific journals or non-governmental organizations (NGOs). EPA does not look at whether a pesticide is essential for crop production, or whether less toxic alternative products could do the same job. There are health and environmental data requirements, but some of these can be delayed through a "conditional" registration that allows a pesticide to market without a full assessment of its risks. This process results in widespread farmworker poisoning, and pesticide residues on food that are causing growing concerns, given their connection to diseases like cancer, autism, learning disabilities, birth defects, Parkinson's, diabetes, and other health impacts. It has also resulted in widespread insect and weed resistance, water contamination, soil degradation, and pollinator and other insect decline.

Although pesticides and other materials approved for organic production "sunset" (removed for use) after five years, unless a super-majority of the stakeholder board votes to retain the product, EPA-registered pesticides are notoriously difficult to remove from the market when hazards are discovered, requiring the government to spend significant resources on lengthy negotiations, and possibly litigation, with pesticide manufacturers.

Readers of *Pesticides and You* know that we are just as tough on organic standards as we are on regulations governing conventionally grown crops. That's because it takes

SHARE WITH US!

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

constant input from consumer advocates to make certain the organic label is adhering to its founding principles, and not watered down. Make no mistake, there are a select few organic pesticides of concern still in use, notably copper and sulfur-based products. Note that organic standards impose strict monitoring and restrict levels of copper that can be added to the environment. And with any pesticide in organic, its use is not allowed without an "organic systems plan" that, through soil management, can avoid or limit most uses. Beyond Pesticides will continue to work with the public and farmers to continually improve organic and remove uses of allowed materials when the data supports the need to do so. We have successfully contributed to the elimination of neurotoxic rotenone in banana production and antibiotics in organic apple and pear production, and with public help will seek to maintain the integrity of a rigorous review process that the public can trust.

Organic is not always perfect, but the standards allow for the continuous improvement of organic systems with transparent and participatory decision making. On the other hand, without reform from either within or outside EPA, conventionally produced foods will continue to use a vast number of highly toxic pesticides that put public health and the environment at unnecessary risk.

Regarding safety, numerous studies have shown that switching from a conventional to organic diet significantly lowers detectable pesticide levels in the body. So, we do know that switching to organic makes a big impact in the amount of your pesticide exposure. To further highlight why organic food is the right choice, Beyond Pesticides created the *Eating with a Conscience* (EWAC) database. Visit EWAC for a run-down on the dozens of toxic pesticides allowed to remain on conventionally grown food before it gets to the dinner plate, as well as the impacts these chemicals have on farmworkers and pollinators that help produce our food [*bp-dc.org/eatingconscience*].

Where Can I Get the Low-down on Chemicals Used in Pesticide Products?

I'm trying to do some research on the chemicals used by the lawn care company my homeowner association (HOA) has hired. Can you direct me to some resources?

Fred, Charlottesville, VA

Hi Fred,

Our website (*beyondpesticides.org*) is a great place to start your research. If you have already obtained the label for the product(s) your landscaper is using, look there to find the active ingredient. [Note that pesticides products or formulations include a mixture of chemicals, beyond the active ingredient, not disclosed on the product label—creating a large area of concern.] We are working to capture health and environmental data for all active pesticide ingredients registered by EPA through our *Gateway on Pesticide Hazards and Safe Pest Management* [*bp-dc.org/gateway*], but if you come across a chemical we have not listed, we hope you'll contact *info@beyondpesticides.org* to let us know. The *Gateway* provides for each active ingredient data on the chemical's health and environmental effects, ranging from cancer, its potential to leach into groundwater, to its toxicity to pollinators. These cited data points can be used to make the case against the use of these chemicals by your HOA. But, convincing individuals about a pesticide's hazards is only one part of the equation. To rid your community of toxic pesticides, you need to explain the viability of the alternative approach. Visit our *Lawns and Landscapes* program page [*bp-dc.org/lawns*] for fact sheets on organic land care, and resources for organic soil fertility and organic compatible products for pest problems. We are available to assist you in moving forward.

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 (2/11/19): *Tell Oregon Department of Agriculture to Ban Tree-Killing Herbicide, Aminocyclopyrachlor (ACP).* ACP is a tree-killing pesticide masquerading as a broadleaf herbicide. The Oregon Department of Agriculture (ODA) has the opportunity to lead the country in banning this inherently dangerous chemical.
Mark comments: Thank you. Tree-killing pesticides will erode our ecosystems, cause damage to all vegetation and denude our forests.
Lynn comments via Facebook: In my state, they spray not just the roadsides, but all the trees and shrubs growing on the sides of the roads. It's so ugly to drive down a beautiful scenic highway and see nothing but brown dead leaves and grass.

Excerpt from Beyond Pesticides Daily News Blog (1/16/19): *Western Monarchs Experience Catastrophic Declines over the Last Year.* Preliminary counts in California indicate the western monarch butterfly population dropped 86% from 2017 to 2018.
Felicia comments via Facebook: This is absolutely heartbreaking! One of the most beautiful sights in the East Bay Hills was always the monarch migration.
Tom comments via Facebook: When I was a kid in grade school, they were in the school yard every year. Uncountable numbers. They aren't there anymore. They have gone the way of the dinosaur.

Drinking Water Contaminated with Neonicotinoid Insecticide Byproducts

Scientists at the U.S. Geological Survey (USGS) and the University of Iowa (UI) have published worrisome news on the neonicotinoid insecticide front. In "Chlorinated Byproducts of Neonicotinoids and Their Metabolites: An Unrecognized Human Exposure Potential?," published in *Environmental Science & Technology Letters* in January 2019, the authors report the discovery of two metabolites of imidacloprid (a neonicotinoid insecticide) not previously identified in drinking water—desnitro-imidacloprid and imidacloprid-urea. The researchers note that these metabolites, created as a result of typical water treatment (chlorination and/or pH treatment), have never been evaluated for their potential risks to human and environmental health, saying: "The mammalian toxicity of transformation products formed during water treatment processes remains unknown. It is possible that chlorination of neonicotinoids and their metabolites will . . . alter their bioactivity."

Bug Bombs Don't Work—At All

If people buy it, it must have benefits, says EPA. But, according to research published in the journal *BMC Public Health* (January 2019), bug bombs do not work. Bug bombs are completely ineffective at reducing German cockroach infestations. Not only are the bombs ineffective, the research indicates that these products are putting people at unnecessary risk. "In a cost-benefit analysis, you're getting all costs and no benefits," said Zachary DeVries,

Lawsuits Filed to Protect Endangered Species

ACTION REQUIRED ON BUMBLEBEE

Although the rusty patched bumblebee was placed on the endangered species list in 2017, the Trump Administration has failed to put in place legally required safeguards for the species. As a result, the Natural Resources Defense Council (NRDC) is suing the Department of the Interior (DOI) for failing to designate locations where specific protections could help restore the endangered bumblebee's population. Advocates say DOI's failure to comply with requirements under the 1973 *Endangered Species Act* (ESA) is consistent with the Trump Administration's continued disregard for ongoing pollinator declines and environmental protections in general.

Under ESA, DOI is required to determine "critical habitat" that contains physical and biological requirements a listed species needs in order to recover. That area must be designated within one year of placing a species on the endangered list, using best available scientific data.

PESTICIDES' IMPACT ON CRITICAL HABITAT IGNORED

A petition submitted in January by the Center for Biological Diversity (CBD) calls on the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) to initiate rule-making to prohibit nearly all pesticide use in areas that are deemed critical habitat for endangered species. It asks these federal agencies to use their authority under ESA to protect wildlife from the threats caused by pesticides—which both agencies have long recognized.

In its press release, CBD notes that it is suing "after decades of intransigence by the Environmental Protection Agency [required to conduct consultations with wildlife agencies], which has refused to comply with the legal mandates of the *Endangered Species Act* to protect the nation's most imperiled species from highly toxic pesticides like chlorpyrifos and atrazine that are known to harm wildlife."

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Antibiotics in Citrus Production Take the "Good" Out of Morning

Time to put the "good" back in morning with *organic* orange juice. Despite the national and international crisis of deadly bacterial resistance to antibiotics, the Environmental Protection Agency may make permanent its 2017 emergency use decision to permit up to 480,000 acres of citrus trees in Florida to be treated with more than 650,000 pounds of the anitbiotic streptomycin per year; 23,000 citrus acres in California will likely be treated annually. The decision allows residues of streptomycin, having previously finalized allowed residues of the antibiotic oxytetracylcine.

Both antibiotics are being allowed for the purpose of controlling a bacterial disease, citrus greening (Candidatus Liberibacter asiaticus [CLas] bacterium that causes Huanglongbing). The World Health Organization has called bacterial resistance "one of the biggest threats to global health, food security, and development today." Organic standards do not allow antibiotic use. Organic citrus growers use organic soil management practices and biological controls.

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PhD, co-author of the study, "Exposure risks and ineffectiveness of total release foggers (TRFs) used for cockroach control in residential settings." Dr. DeVries said, "Bug bombs are not killing cockroaches; they're putting pesticides in places where the cockroaches aren't; they're not putting pesticides in places where cockroaches are and they're increasing pesticide levels in the home."

EPA Fails to Restrict Roundup, as French Court Issues Ban

An analysis, "How did the US EPA and IARC reach diametrically opposed conclusions on the genotoxicity of glyphosate-based herbicides?," by Charles Benbrook, PhD and published in the journal *Environmental Sciences Europe* (January 2019), adds to the chronicle of U.S. Environmental Protection Agency (EPA) failures to protect human health from toxic pesticides, with a focus on glyphosate. Meanwhile, a French Court has pulled the license for a Roundup product, citing the French government's failure to protect public

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health. In his paper, Dr. Benbrook examines the divergent positions on the carcinogenicity of glyphosate—the active ingredient in a number of herbicides, most notably Monsanto's (now Bayer's) Roundup—taken by the International Agency for Research on Cancer (IARC) and EPA.

Dealmaking Protects Farmworkers

Dealmaking on Capitol Hill extracted an EPA agreement to drop its plan to weaken farmworker protections from toxic pesticides in exchange for Democratic Senators' support for the confirmation of Alexandra Dunn to the EPA Office of Chemical Safety and Pollution Prevention. The irony that a deal is necessary to get an agency with protection in its name to do its job was not lost on the dealmakers. Under former EPA Administrator Scott Pruitt, the agency backtracked on provisions put in place during the Obama administration to update farmworker protections following decades of inaction. In March of last year, 28 Senators urged then-Administrator Pruitt to retain farmworker protections. The new Administrator, Andrew Wheeler, had announced in October that he was moving ahead with the reversal.

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Tree-Killing Weed Killer Subject to Restrictions in Oregon

Due to an herbicide, nearly 1,500 dead or dying trees have been reported along Oregon's iconic state road 20, home to old growth ponderosa pines. Many of these 150- to 300-year old trees are now dead from aminocyclopyrachlor (ACP), a tree-killing pesticide that is sold as a broadleaf herbicide. The Oregon Department of Agriculture (ODA) agrees and has said, "Because [ACP] is a relatively new herbicide it is unknown how many trees stressed from past applications of [ACP] will die in the future." Even at tiny levels, ACP run-off and drift kills trees.

In 2014, DuPont chemical company settled a nearly $2 million lawsuit with the U.S. Environmental Protection Agency (EPA) after the herbicide (under the brand name Imprelis®) was found to kill trees at golf courses, homeowners associations, businesses, and private residences. Despite this history, regulators left ACP on the market. Its use was banned on lawns and turfgrass, but allowed for roadside rights-of-way. A couple years ago, Bayer purchased the rights to ACP from DuPont and continues to market and sell the chemical under the brand names Perspective®, Streamline®, and Viewpoint®.

ODA announced late last year that it was temporarily banning the use of ACP on roadsides while it put together a new rule. ODA is considering public comments on its proposal to make its temporary ban on roadside uses permanent. Oregon officials stopped short of proposing a complete ban, allowing a limited one-time per year exemption from the ban when spraying an invasive weeds in a limited area.

An Organic Diet Is Safer, Study Corroborates

A study conducted by University of California Berkeley, supported by Friends of the Earth, and published in the journal *Environmental Health* (January 2019) demonstrates that consumption of organic foods reduces significantly the levels of synthetic pesticide residues in the bodies of U.S. children and adults. Although the test population is relatively small, the study adds to the evidence that organic food production and consumption are key to protecting human health. The study measures in the urine of research subjects residues of metabolites and parent compounds of neonicotinoids, organophosphates, pyrethroids, and 2,4-D. The most significant reductions are identified for the organophosphates malathion and chlorpyrifos, chemicals of urgent concern because of their extreme neurotoxicity, particularly for children.

The study, "Organic diet intervention significantly reduces urinary pesticide levels in U.S. children and adults," corroborates previous work showing that consumers take in significant and health-threatening levels of pesticides through conventional diets, and can dramatically reduce these intakes by switching to organic. A 2018 French research study of adults finds that the most frequent consumers of organic food have 25% fewer cancers overall than those who never eat organic, and that those with the highest percentages of organic foods in their diet see significant reductions in the incidence of lymphomas and postmenopausal breast cancers. In 2006, researchers note that pesticide metabolites drop to below detectable limits after an organic diet intervention and remain undetectable until a conventional diet is resumed. In a 2014 Australian study, a one-week organic diet protocol results in reductions of two pesticide metabolites by 89% and 96%, respectively. Taken together, these research results establish what many would say is the obvious—food grown with chemical-intensive practices result in greater dietary exposure to pesticides than food produced in organic systems.

Bavarians Petition to Save the Bees

Residents recently rallied in Bavaria—a southern state of Germany—in an effort to save the bees. Braving the cold in eye-catching bee outfits, a broad coalition of activists collected over a million signatures (the necessary 10% of the state's eligible voters) to move a petition into the state legislature. The petition pushes forward changes in farming practices to support pollinators. While bees are the charismatic champion of the campaign, petitioned changes will support biodiversity in general. Now that signatures are gathered, the state parliament has three months to either accept the proposal or put it to a statewide referendum.

Native Bee Protections Inadequate, Scientists Say

It is well-known now that pollinators are in trouble worldwide. A series of papers by biologists at the University of Guelph, Ontario, posits that pesticide regulations aimed at protection of honey bees fall far short of the critical task of protecting the multitude of bee species that are important pollinators of human food crops. These recent papers, drawn from 2017 workshops, entitled "Workshop on Pesticide Exposure Assessment Paradigm for Non-*Apis*Bees: Foundation and Summaries," brought together 40 bee researchers from various universities, and representatives from Canadian, U.S., and European regulatory agencies, and the agrochemical industry. Beset by shrinking habitat, pathogens, and toxic chemical exposures, bee pollinator populations are at great risk, even as "'our dependency on insect-pollinated crops is increasing and will continue to do so as the global population rises,' said [Professor Nigel] Raine, [PhD], [a] co-author of all three papers recently published in the journal *Environmental Entomology* . . . . Protecting wild pollinators is more important now than ever before. Honeybees alone simply cannot deliver the crop pollination services we need." There are, in fact, more than 20,000 bee species worldwide, and 3,500–5,000 bee species in North America alone.

Glyphosate Researchers, Attacked by Industry, Win Science Award

The American Association for the Advancement of Science (AAAS) has awarded two researchers the group's Scientific Freedom and Responsibility Award for their work uncovering the link between glyphosate and chronic kidney disease (CKD), which has killed at least 25,000 Sri Lankans and 20,000 Central Americans. Award recipients Sarath Guanatilake, MD and Channa

Catastrophic Decline in Western Monarchs Last Year

Preliminary counts in California indicate the western monarch butterfly population dropped 86% from 2017 to 2018, according to a survey by volunteer citizen scientists organized by the Xerces Society. The trend from the initial sample (97 sites) finds that the population of overwintering butterflies is estimated to be less than 30,000—0.05% of its historical size.

To get an accurate count of monarch populations, volunteers follow a monitoring guide, which recommends beginning a count on a still, cool, and dry morning so that monarchs are still clustered together. Volunteers count a small cluster of monarchs and then extrapolate that number to arrive at a total for the larger cluster being observed. Citizen science has been crucial to understanding the decline of monarchs and insects worldwide. As reported by *The New York Times,* the escalating *Insect Apocalypse*—with devastating declines in total insect populations—has been documented with data captured by volunteers and scientists writing for peer-reviewed science journals.

Using statistical analyses of citizen science data, a 2017 study reported in *Biological Conservation*" (2017), "Citizen science monitoring demonstrates dramatic declines of monarch butterflies in western North America," calculates the extinction risk of monarch butterflies in western North America to be ~50–70% within 20 years, and ~65–85% within 50 years. The precarious situation of the butterfly population can be attributed to both recent events and long-term stressors, including pesticide use.

Jayasumana, PhD faced death threats and claims of research misconduct as they went toe-to-toe with agrichemical industry giant Monsanto (now Bayer's Monsanto), the major manufacturer of glyphosate-based products, including Roundup.

"To right a wrong when significant financial interests are at stake and the power imbalance between industry and individual is at play takes the unique combination of scientific rigor, professional persistence and acceptance of personal risk demonstrated by the two scientists recognized by this year's award," says Jessica Wyndham, director of the Scientific Responsibility, Human Rights and Law Program at AAAS.

Maryland County Bans Glyphosate (Roundup) in Its Parks, Pending Complete Pesticide Ban

Prior to a pesticide ban taking effect in Montgomery County Maryland Parks, the Department of Parks announced in December 2018 that it would discontinue the use of glyphosate-based herbicides through March 2019, just before it usually begins spraying. The agency has used glyphosate as part of its Integrated Pest Management (IPM) program for weed management. Montgomery Parks indicates it will release further information on the use of glyphosate in mid-March. In November last year, Montgomery County Council member Tom Hucker wrote to the head of Parks, supported by a community-wide petition, urging that glyphosate be banned immediately.

In 2016, Montgomery Parks instituted a pesticide reduction program in compliance with Montgomery County, Maryland's 2015 adoption of County Code 33B, which phases out the use of toxic pesticides on county-owned property, including parks, and on private property. In 2017, a Montgomery Circuit Court overturned the portion of the law pertaining to a ban on private land, saying that it would "conflict with federal and Maryland state regulations that allow the use of the pesticides." The council has appealed that ruling, and in June 2018, an amicus brief was filed by 10 organizations, including *Beyond Pesticides*, in support of the 2015 ordinance.

Urban farm at Wager Houses, New York City Housing Authority, New York, New York.

Acute Pesticide Incidents Lead to Loss of Smell

Individuals who have been acutely poisoned by pesticides at some time in their life are more likely to lose their sense of smell, according to a recent study published in *Environmental Health Perspectives*. Researchers focused on the effect of high pesticide exposure events (HPEE), such as a pesticide spill or other incident, on a farmer's ability to smell later in life. This study, "High Pesticide Exposure Events and Olfactory Impairment among U.S. Farmers" (January 2019), is the first to indicate pesticide exposure may result in olfactory impairment.

Social Justice Serves People and Pollinators

A UK Study concludes that the expansion of community gardens, identified as "pollinator hotspots" with "high pollinator diversity," offer an important opportunity for assisting ailing pollinator species and improving community quality of life. Writing in *Nature Ecology and Evolution* (January 2019), the researchers say towns and cities can be planned and managed more effectively to steward existing urban biodiversity and create essential havens for pollinators and people under stress. To increase city-scale robustness, the researchers, in "A systems approach reveals urban pollinator hotspots and conservation opportunities," advise increasing community garden allotments, planting perennial flowering plants in cemeteries, and improving management of public parks. The authors explain that increasing the number of community gardens, particularly in low-income neighborhoods, is the best strategy per unit area, as it would expand viable habitat for pollinators throughout cities, while providing much-needed green space and food sources for people.

Scientific Findings Support Replacing Poisons with Precaution

In the face of limitations in defining and regulating pesticide hazards, medical doctor and epidemiologist calls for avoiding pesticide use and adoption of the precautionary principle.

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EDITOR'S NOTE: Dean Baker, MD, MPH, is professor emeritus of medicine, epidemiology and public health in the School of Medicine, and former director for 23 years of the Center for Occupational and Environmental Health, University of California Irvine, California. This piece is taken from a talk, **Protecting Family Health and the Environment**, given by Dr. Baker to the 36th National Pesticide Forum, **Organic Neighborhoods: For healthy children, families, and ecology**. In this piece, Dr. Baker explains the complexities of studying the health effects of pesticides—from evaluating toxicity, exposure, and health outcomes. Because of the severe limitations in defining risk, he challenges us to embrace a prevention-oriented approach to chemical use under the precautionary principle, which states: When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. The context of his experience as a medical researcher and epidemiologist, as explained in this discussion, is central and important to his conclusion that we must urgently adopt alternatives to toxic pesticide use.

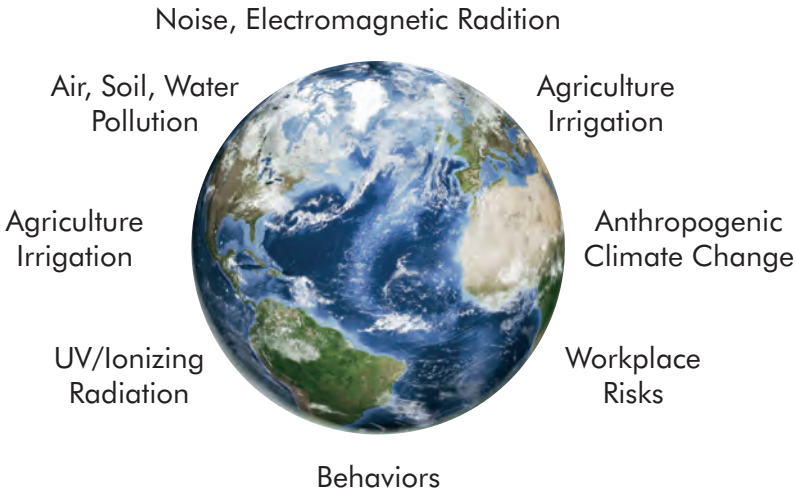
DEAN BAKER, M.D.

The role of people like myself, academics who do research, is, one, to generate research and new knowledge, and, two, to be supportive of communities—because ultimately it takes community and people action to get things done.

The purpose of my talk is to give you an overview and introduction. The basic point to make is that, according to the World Health Organization (WHO), 22% of the global burden of disease is due to environmental factors. By that, beyond diet, they mean air, soil, water pollution, noise, the built environment, and agriculture. I am going to focus on pesticides, but there is a whole world of environmental factors. Collectively, environmental factors cause up to 22% of deaths in children less than five years of age. They list indoor and outdoor pollution. Indoor pollution includes mold, indoor combustion worldwide of organic materials (which is one of the major causes of death and disability among the women who are cooking and the children), lack of water, sanitation, disease vectors, inadequate food supply, and chemical hazards—with pesticides being one of the chemical hazards. We all know the story about lead, heavy metals, plasticizers, flame retardants. So there is a long list of chemical hazards.

FIGURE 1

World Health Organization: Environmental Factors Responsible for 22 Percent of the Global Burden of Disease



26% of deaths in children under five years due to modifiable environmental factors (WHO, 2016).

Photo: © iStockphoto/Jimmy James Bond

DEFICIENCIES IN ESTABLISHING SAFETY

Many of the themes we will talk about are the challenges in trying to get good regulation, regardless of the chemical, to reduce exposures. So, what are we facing? There are millions of chemicals registered in the chemical registry of the American Chemical Society, or the Chemical Abstracts Service (CAS) Registry. There are over 80,000 chemicals that are produced and used in the United States, most of them having been synthesized in the past 50 years. There are 2,000 new chemicals introduced into commerce every year. The majority have not been tested for other than acute toxicity. Over 95% have not been tested for their effects to children.

In biological surveys, like the National Health and Examination Survey (NHANES), many of these chemicals in trace amounts are found in most Americans. In some cases, like DDE (the breakdown product of DDT), even though it has not been allowed in the U.S. for decades, 99% of the population has at least trace levels in their blood. Because of the poor testing and the challenges in conducting research, we really have the classic toxic iceberg of what is known, what is partially

BOX 1

In Response to a Pesticide Tragedy

The Center Occupational and Environmental Health was created at University of California Irvine, along with centers at UCLA, UC San Francisco, UC Berkeley and UC Davis, by state law in 1978. The law provided permanent funding for research, training, and service in occupational and environmental health. We at Irvine have programs in occupational and environmental medicine. We train specialist doctors in the field. We also have graduate programs in exposure, toxicology and epidemiology. I think the poignancy of the centers is that they were actually funded by the state in response to an episode in the mid-1970s where workers at a plant in northern California were exposed to 1,2-Dibromo-3-chloropropane (DBCP), which is a fumigant

The story basically unfolded as workers at this plant socialized together. They had a baseball team, and while they were out there playing baseball, a lot of their spouses would be sitting in the stands. They got to chatting with each other and realized that none of them had kids for a while. They thought this was unusual and they talked with some public health officials. So, they started to do an investigation and they tested the men and they found out that almost everybody who had worked at the plant for a year or more either had no sperm or a very low sperm count, and were virtually sterile. They did some research on it and found that DBCP was produced in this plant.

DOW (and Shell) had done research, which was published in obscure journals in the mid-1950s, 25 years earlier, that showed that in animal toxicology studies there were atrophied testicles and sterility in male animals that had been exposed to this pesticide. But, it was industry-sponsored research and never made it into the broader literature. This led to, as you might imagine, outrage in the state and it eventually led to the state legislature deciding that public funding was needed for more research and the training of more professionals in the field.

Our center, which has existed since the late 70s, really came about because of a pesticide and an unfortunate history about its use and in hiding the pesticide's adverse effects from the public. It is quite appropriate that the Center would be a cosponsor of the National Pesticide Forum. The research did lead to the banning of the use of DBCP in the U.S., at least, by 1979. It was allowed for several more years in Hawai'i before it was banned there. And, it was allowed on banana plantations in Central America, where there have been lawsuits going on until quite recently on worker exposure to the chemical. So, it can be banned for use in the U.S., but it can still be manufactured and exported.

Environmental Risks
Identified by the World Health Organization

Outdoor air pollution
Indoor air pollution
Lack of water and inadequate sanitation
Disease vectors, such as mosquitoes
Inadequate food supply—malnutrition
Chemical hazards and hazardous waste
Injuries
The built environment
Disasters and conflicts
Global environmental change

proven, and what is not yet recognized—and perhaps will be forever unrecognized. Even with all the bad news, there is probably worse news out there when we eventually find out about the toxic extent of our problems.

WHAT DO WE KNOW?

We know that children are more vulnerable than adults. They are not just little adults. They have developmental toxicity. From the time of gestation, in development, which does not end at birth, the nervous system is still developing. That is why children do not get up and walk right away. Their nervous system has not completed the myelination of the long nerves. This cell differentiation, organ development, and growth continue through early life and adolescence. Children are rapidly growing and developing. They have less developed natural defenses. For example, lead that gets into the gut is more easily absorbed. Lead that is absorbed more easily crosses the blood-brain barrier to the brain, which is a target organ. Even when exposed to the same amount of lead as an adult, children actually get more exposure dose at the target organ. In addition, the developing brain is more vulnerable—more exposed, more absorption, more to the target organ, and more vulnerable target organ. They have more skin per pound of body weight and eat more per pound.

We also know that children are natural explorers. They spend more time on the ground or floor. They have mouthing behavior that creates another pathway—ingestion.

FAMILY HEALTH

In looking at all family members, puberty can be a vulnerable period. Exposure at puberty can have effects on sex differentiation and growth of reproductive organs, pregnancy, reproduction, and aging. We are now starting to focus on the environmental factors that influence age of menarche (the first occurrence of menstruation), menopause in women, and premature ovarian failure. There is growing research evidence of environmental factors, studied by neurotoxicologists, associated with Alzheimer's and Parkinson's disease, and the quality of aging and cognitive decline, again associated with environmental factors that can lead to oxidative stress (the imbalance of unnatural sources of oxidizing substances, including toxics, and antioxidants in the body). There are occupational and community exposures that often cause the highest exposure in economically disadvantaged populations, like farmworker communities.

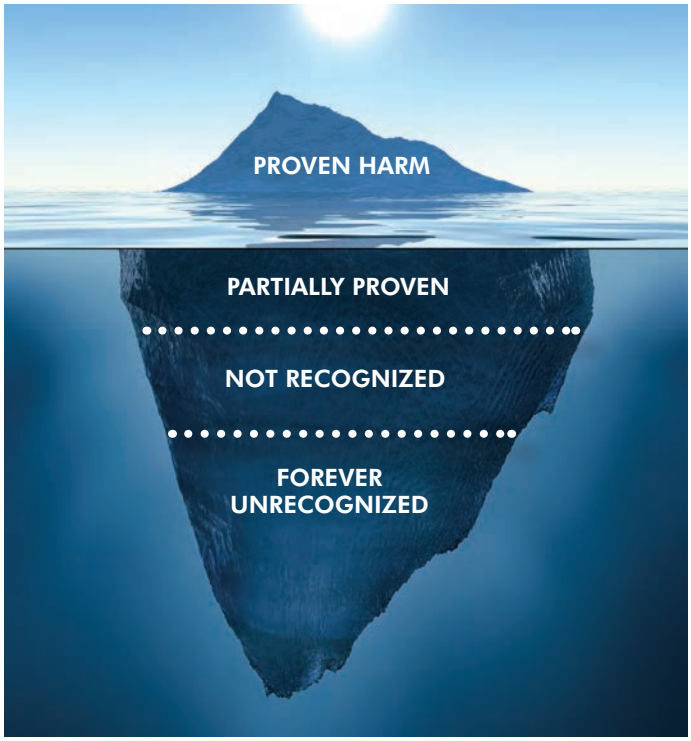
HOW DO WE STUDY ENVIRONMENTAL FACTORS?

There are the exposure sciences that measure the pathways of exposure, the settings and the media, to try to understand whether there is a completed pathway of exposure from where a pesticide is being sprayed. With aerial spraying and drift, it is inhalation exposure, but we have to understand that putting a school next a field that is being sprayed is not very smart.

In toxicology and basic sciences, we hear a lot about animal studies and the research on mechanisms. It is probably the area that is given the most weight by the regulatory agencies. But it is limited because, while acute toxicity can be studied, for chronic toxicity—transgenerational, reproductive, and neurodevelopmental effects—there are not great assays and they are not really supported. So, there is a lot that we do not know. slide

Epidemiology, what I do, studies the patterns of effects in human populations, in the workplace, home, and community. Risk assessment tries to put all this information together and

FIGURE 2
The Toxic Iceberg



BOX 2

Children's Health

What do we know about children's health and development? The patterns of illness of children in developed countries have changed substantially in the past hundred years, particularly with nutrition and control of infectious diseases. We still have a lot of premature births and birth defects, asthma, injuries, childhood cancers, neurodevelopmental disorders, obesity, and diabetes. There are adverse trends for a lot of these.

Asthma prevalence went up dramatically from the 1980s to the mid-1990s and has leveled off since then. Over 30% of children are either overweight or obese. Children diagnosed with Attention Deficit/Hyperactivity Disorder (ADHD) and the percent of children with autism spectrum disorders has gone up. While it was thought that there could be a diagnostic or recognition bias, the Centers for Disease Control and Prevention (CDC) funded in several different states a study with an evaluation, examination, and diagnostic protocol and five years later, using the identical protocol and criteria, showed that there was a real increase in autism spectrum disorders not due to study bias. ADHD is clearly increasing.

FIGURE 3

Trend in Overweight (≥30 kg/m²), Children 12–17

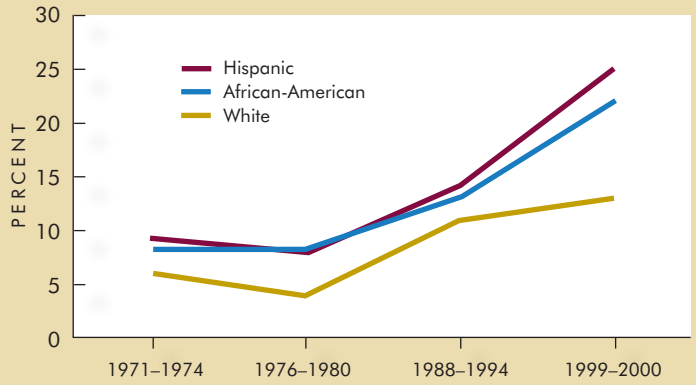
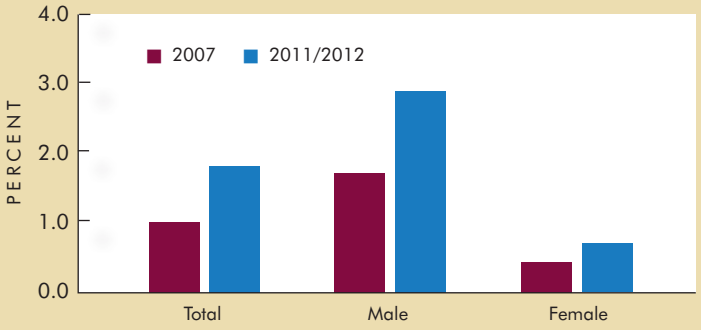


FIGURE 4

Percentage of Children Ages 3–17 with Autism Spectrum Disorders, 2007 and 2011/12



Source: National Survey of Children, Health Resources and Services Administration

make some estimates about what amount of exposure or dose might be acceptable in the population.

The Centers for Disease Control and Prevention (CDC), the Agency for Toxic Substances and Disease Registry (ATSDR), created by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA—the Superfund law), conducts work that shows there are multiple pathways of exposure through inhalation and ingestion from an industry, the pollution of rivers, the soil, and the food supply. In order to understand, from the toxicology to the translation into epidemiology and human health effects, we have to be able to measure exposures—which is quite complicated. So, there is a whole field of exposure science.

EPIDEMIOLOGY: MEASURING REAL WORLD EFFECTS

In epidemiology, we have to keep in mind that there are many domains of exposure. Some of them can have similar effects, synergistic effects, and additive effects. Therefore, we have to look at chemical, physical, psychosocial, and biological exposures. Of course, genetics is a risk factor, although not an exposure. We know about gene expressions. Although we have set genes, through epigenetics and other mechanisms some can get turned on and some get tuned off. This can all be modified by health care, education, and home and community environment. A range of outcomes can be caused, affecting pregnancy, neurodevelopment and behavior, asthma, obesity and growth, child health and development, injury, and reproductive development.

We have the additional complication, which I refer to as "life course epidemiology," since we have multiple exposure, mediators, and outcomes. All of this occurs over time. Again, some exposures are high enough and cause acute effects, but many exposure do not cause acute effects, but go on for a long time and cause delayed or chronic effects. In order to really study these, we have to look at the exposures in the many

domains, combined with the genetics and the epigenetics, and look over the life course from pregnancy, infancy to childhood—follow people and look for the outcome. That is the challenge that we face in epidemiology and generally in environmental research.

CASE STUDY: HEPTACHLOR

A retrospective cohort study looked at the use of heptachlor [an organochlorine pesticide in the DDT family], which was banned from use on the continental U.S., but in the early 80s it was still allowed on the pineapple plants in Hawai'i because they said there was no alternative. So, what happened? In 1980 to 1982, heptachlor was sprayed on the pineapple plants to control ants and mealybugs, but after harvest it got into the milk supply and pregnant women drank it. Many years later, we were asked to go back and we showed that the mothers drinking milk was associated with higher blood levels of the chemical in the women. Then we were asked 15 years later to do a neurobehavorial study. What we found, when we studied high school students who were randomly selected, was that the mothers' reported milk consumption was associated with worse neurobehavioral performance and more behavior problems reported by the teachers—who clearly did not know anything about the mothers' exposure to the milk. We then did a neurobehavioral study in which we gave the adolescents pneumococcal vaccinations and we went back six weeks later and got titers [measured antibodies]. What we found is that among the Oahu born children there was an inverse dose response—the lower the titers the more the mother drank milk. In a non-Oahu born cohort, we did not see that effect.

THE CHALLENGES OF ASSESSING HAZARDS

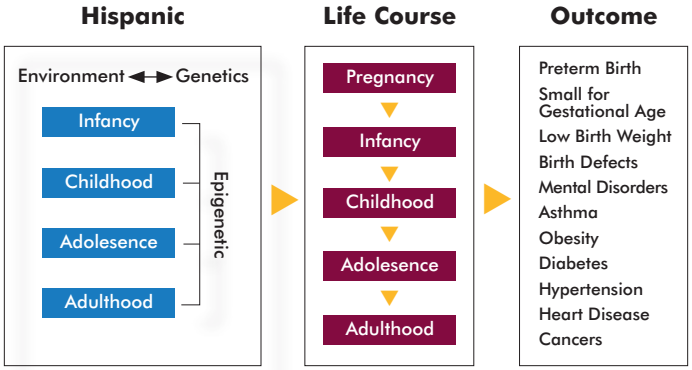
So, there are challenges: Exposure Assessment—multiple exposures, transient exposure; Toxicology—few chemicals are fully tested for toxicity. Most are tested for only acute effects, and; Epidemiology—there is a long latency. Addi-tionally, there are windows of vulnerability, so it is not just the pure dose and exposure, it is when the dose and exposure occurs. There are vulnerable subpopulations, gene-environment interactions, and lots of technical issues related to how we select populations, how to make sure your comparison populations are actually comparable, and how to measure exposure and outcomes without errors, or biases.

SUPPORTING RESEARCH

Research takes time and requires funding, while hazards continue. We cannot just wait for the research to be done. Now, the funding for environmental and occupational health research, particularly at the federal level, is abysmal. Actually, the White House budget proposed a zero extramural funding budget for the National Institute for Occupational Safety and Health this year. Do they not want research because they do not want to have those answers out there?

FIGURE 5

Life Course Epidemiology



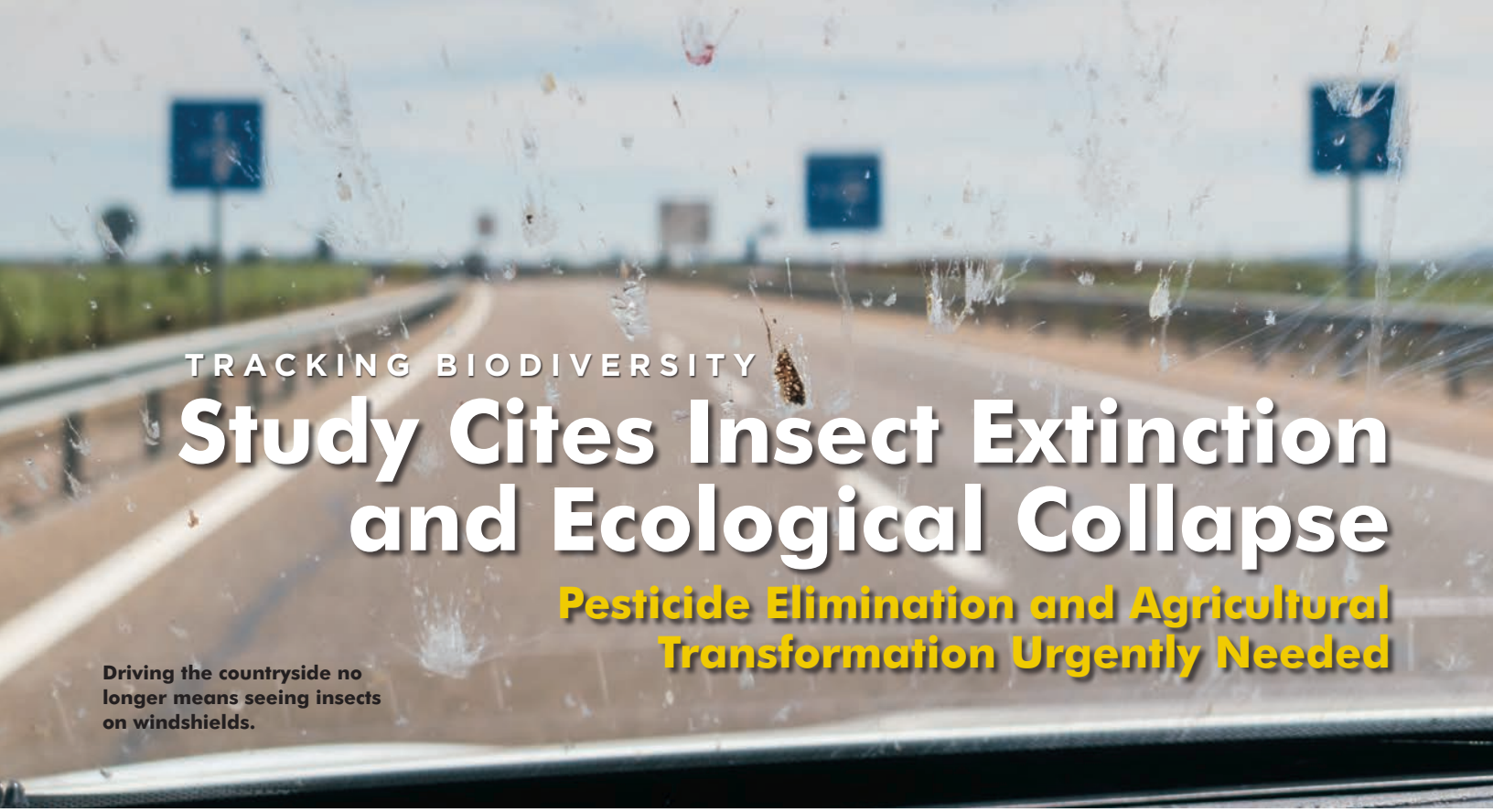
We know a lot about pesticides and their effects. But, there is a lot we still must learn. I look at it as the challenge of new pesticide production and whack-a-mole research. We had organochlorines. Then they were replaced by organophosphates and carbamates. Then it is on to new classes of chemicals. We do research and show that is harmful and it is on to new classes of chemicals. It is whack-a-mole. They keep producing and we keep showing there is harm because pesticides are meant to cause harm. Continuing research needs on health risks require that we look at multiple pesticides, combined effects, effects of adjuvants [chemical added to boost performance], effects in vulnerable populations, and the development of appropriate risk assessment strategies to lead to efficient and quick regulation to protect, rather than waiting years and years for research to take place.

PREVENTION AND THE PRECAUTIONARY PRINCIPLE

The fundamental approach requires a prevention orientation toward diseases caused by toxic chemicals that are preventable. We need to think about prevention in the context of the home, school, community, clinical practices of physicians, research, advocacy, and legislation. slide

This leads to the precautionary principle—when an activity raises threats of harm to the environment or human health, precautionary measures should be taken, even if some cause and effect relationships are not fully established scientifically. We cannot wait for the final answers. Research just takes too long. In this context, the proponents of this activity, rather than the public, should bear the burden of proof. This is an approach that is being taken more in Europe and it needs to be taken more in the U.S. In the meantime, we cannot rely on regulations. We have to use local and personal actions to take precaution.

To view a video of Dr. Baker's talk, please go to bp-dc.org/protectinghealth.



Driving the countryside no longer means seeing insects on windshields.

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TRACKING BIODIVERSITY

Study Cites Insect Extinction and Ecological Collapse

Pesticide Elimination and Agricultural Transformation Urgently Needed

SARAH BLUHER

A new systematic review of insect population studies worldwide reports on "the dreadful state of insect biodiversity in the world," concluding with the dire prediction that at least 40% of the world's insect species will go extinct within 20–30 years if patterns of intensive agriculture and pesticide use continue. In the words of the authors, "[U]nless we change our ways of producing food, insects as a whole will go down the path of extinction in a few decades."

THE DEPTH AND SPEED OF INSECT DECLINE

The review, "Worldwide decline of the entomofauna: A review of its drivers" (January 2019), published in *Biological Conservation*, analyzes 73 insect population studies conducted within the past 40 years, including only those that quantitatively assess all insect species within a taxa over a span of 10 or more years. Researchers Francisco Sánchez-Bayo, PhD and Kris A.G. Wyckhuys, PhD uncover the disturbing truth behind this mass of data: one in every three insect species monitored worldwide is threatened with extinction. Even more concerning is the finding that 41% of insect species worldwide are in decline, outpacing vertebrate declines by 200%. Only a few species are expanding in range or occupying vacant niches—not nearly enough to compensate for the massive losses.

Citizen data is analyzed in 8% of the studies in the review. The authors note that any bias in citizen science reports would dampen the observed species loss effects due to their emphasis on documenting rare species. The authors believe their estimates for biodiversity losses are a conservative lower bound on the true scale of insect declines.

CHEMICAL-INTENSIVE PRACTICES ARE DEVASTATING

More than half of the studies that Drs. Sánchez-Bayo and Wyckhuys review point directly to intensive agriculture and increased reliance on agrochemicals as causal factors driving insect declines. Several more consider pesticides to be the most likely agent, masked under the category of "unexplained factors" in cases where tested variables, such as habitat loss, land use conversion, and climate change, are insufficient in explaining losses. "[T]he intensification of agriculture over the past six decades stands as the root cause of the problem, and within it the widespread, relentless use of synthetic pesticides is a major driver of insect losses in recent times," the authors state.

The review includes a thorough treatment of pollinator declines, pinpointing pesticides as the main driver of massive population and species losses. Worldwide, authors note, "One in every six species [of bees] have gone regionally extinct." The study highlights a comprehensive analysis of nearly half a million records from Britain, which reveal that four separate phases of wild bee extinctions followed directly from specific policy changes expanding the use of chemical fertilizers and pesticides. Similarly, in a study of 576 species of butterflies in Europe, researchers found that 80% of species are negatively impacted by herbicide and pesticide use.

The study notes that systemic insecticides are particularly devastating for pollinator populations. Honey bees serve as well-studied proxies for wild bees and other native pollinators. Historic records and scientific studies confirm that increased honey bee colony losses began immediately following the introduction of DDT and spiked again due to compromised immunity induced by neonicotinoids and other systemic insecticides.

Systemics such as neonicotinoids are incorporated into plants through seed treatment, drenching, or spraying. Systemic insecticides spread through the vascular system of the whole plant and are expressed across all plant parts including pollen, nectar, and guttation droplets. Research findings across several studies confirm pesticide-induced declines in pollinator immune function, resulting in increased susceptibility to common pathogens and parasites:

> The new generation of systemic insecticides, particularly neonicotinoids and fipronil, impair the immune system of bees (Di Prisco et al., 2013; Vidau et al., 2011) so that colonies become more susceptible to Varroa infections (Alburaki et al., 2015) and more prone to die when infected with viral or other pathogens (Brandt et al., 2017). Apart from bringing about multiple sub-lethal effects that reduce the foraging ability of worker bees (Desneux et al., 2007; Tison et al., 2016), neonicotinoid and fipronil insecticides equally impair the reproductive performance of queens and drones (Kairo et al., 2017; Williams et al., 2015), thus compromising the longterm viability of entire colonies (Pettis et al., 2016; Wu-Smart and Spivak, 2016).

Native pollinators are similarly threatened by increased use of systemic insecticides. A California study of butterfly populations monitored from 1972-2012 captured a 65% drop in species counts beginning sharply in 1997, following the introduction of neonicotinoid insecticides to the state in 1995 (Forister et al., 2016). Similarly, a study of wild bee populations in varying U.S. landscapes found the greatest population declines in regions dominated by corn production, a sector in which neonicotinoid use tripled through the study period, accounting for 54% of total use in 2013 (Bennett and Isaacs, 2014).

HERBICIDES AND FERTILIZERS ARE MAJOR FACTORS

The authors point out that insecticides are not the sole culprits behind mass insect declines, citing the adverse impacts of herbicides and chemical fertilizers on biodiversity. Herbicides wipe out valuable habitat and forage in the watersheds surrounding agriculture zones and rights-of-way. Chemical fertilizers replace interplanted legumes—such as clover in lawns—and cover crops, reducing the managed land plant biodiversity that supports insects.

According to the review,

> In terms of toxicity, insecticides are by far the most toxic to all insects and other arthropods, followed by fungicides but not herbicides (Mulé et al., 2017; Sánchez-Bayo and Goka, 2014). Herbicides, however, reduce the biodiversity of vegetation within the crops and in surrounding areas through drift (Egan et al., 2014) and runoff, thus impacting indirectly on the arthropod species that depend upon wild plants, which either disappear completely or decline significantly in numbers (Goulet and Masner, 2017; Marshall et al., 2003). Thus, the application of herbicides to cropland has had more negative impacts on both terrestrial and aquatic plants and insect biodiversity than any other agronomic practice (Hyvonen and Salonen, 2002; Lundgren et al., 2013).

The proof is in the numbers: among insects threatened by pesticide use, those species that rely on farm flowers and traditional nitrogen-restoring crops for forage have experienced some of the largest reductions. Three independent studies conducted in England, Denmark, and Sweden show that long-tongued bumblebee species, which rely on farm flowers, clover, and other legumes for forage, have experienced larger declines over the last half century than short-tongued species. A U.S. study found that regions with high percentage intensified agricultural land ranked among the worst for bumblebee declines, contributing in large part to the steep drop in half of all U.S. bumblebee species, by up to 96% of initial counts. Critically, once plant specialists die out due to herbicide and fertilizer use, lack of available forage prevents the spread of new specialists, while surviving generalist species fail to fill the vacant niche. With no new specialized pollinators to aid their spread, the plants that extinct specialists once pollinated are threatened by reduced yield, in the case of managed crops, or reduced range and eventual extinction, for wild plants.

While specialist losses are alarming, the authors warn that losses of generalist species are even more so. Generalist pollinator species, such as the peacock butterfly and v-moth, have experienced major declines in the last half century. Once ubiquitous freshwater generalists (among them stoneflies, caddisflies, mayflies, and dragonflies) are rapidly disappearing from North American and European waterways. Such generalist declines signal a systemic, chemical-induced problem that extends beyond niche habitat loss.

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BEYOND POLLINATORS: DAMAGE TO SOIL BIOLOGY

While pollinators hold the spotlight, they constitute only one class of insects that are relied on for food production. The study contains further data on declines across insects that prey upon and parasitize common crop pests, as well as insects that are critical to soil fertility.

Both dung beetles and saprophytic beetles, whose actions in soils unlock critical nutrients trapped in feces and dead wood, are in decline. The impacts of dung beetles on soil fertility are vital to the sustainability of farms and pastures used to maintain livestock. By burying and processing feces on cattle farms, dung beetles introduce 80% more nitrogen into the soil than would otherwise remain. By increasing soil organic matter, dung beetles simultaneously increase water infiltration, thus stabilizing farms and heavily grazed areas against erosion, flooding, and drought.

Monitoring in Europe, specifically in the Mediterranean region, shows the greatest terrestrial loss of insect biodiversity on record: more than 60% of documented dung beetle species are in decline. In Spain, dung beetle populations began to decline in abundance and range in the 1950s. Multivariate analyses pinpoint agricultural intensification as a main driver of these declines (Lobo, 2001). Roller dung beetles in Italy declined by 31% in both abundance and distribution beginning in the 1960s, tracing the conversion of pastures to intensive agriculture (Carpaneto et al., 2007). A 1996 survey of dung beetles in a region of France recovered only 11 species out of 72 known species in the region (Lumaret, 1990). Abundance of one species was documented to have decreased 45-fold over a period of 24 years, due in large part to increased insecticide use for livestock maintenance and mosquito control (Lobo et al., 2001).

Dung beetles that unlock critical soil nutrients are in decline.

© iStockphoto/Tami1120

These patterns carry a lesson. Insects that act to control crop pests and fertilize the soil reduce the need for pesticide and chemical fertilizer use. Reliance on chemical controls creates a vicious treadmill: pesticide use kills insect agents of pest control, thus creating a demand for more pesticide use, which kills more of the beneficial insects, and so on.

The impacts of mass dependence on pesticides reach far beyond affected farmers. Insects form the base of the ecosystem that all organisms rely upon. Insects serve as critical food items for vertebrates, such as shrews, moles, hedgehogs, anteaters, lizards, amphibians, bats, birds, and fish. Insects act as natural agents of pest control, maintaining on-farm ecological balance. Insects fertilize and stabilize soil by increasing soil organic matter, and their decline has far-reaching consequences for all plants and animals in terrestrial ecosystems.

INSECT EXTINCTION AS A CALL TO ACTION

The evidence implicating pesticide use in the loss of insect biodiversity is both astounding and unsurprising. Insecticides kill insects, often indiscriminately and with devastating consequences for biodiversity, ecosystem stability, and critical ecosystem services. Herbicides and chemical fertilizers extinguish invaluable habitat and forage critical to insect survival. Taken together, insecticides, fungicides, herbicides and chemical fertilizers make large and growing swaths of land unlivable for vast numbers of insect species and the plants and animals they sustain. More overwhelming still is the authors' prediction about the future with continued reliance on agrochemicals—continued mass extinction of insects that form the foundation of the entire ecosystem.

The authors offer a solution to the sobering reality they present. "A rethinking of current agricultural practices, in particular a serious reduction in pesticide usage and its substitution with more sustainable, ecologically-based practices, is urgently needed to slow or reverse current trends, allow the recovery of declining insect populations and safeguard the vital ecosystem services they provide."

Beyond Pesticides holds the position that toxic pesticides can be eliminated in organic land management systems, and that pesticide reduction is not sufficient in the face of the escalating crisis. We can commit to complete transformation of our agricultural system to stave off the dire fate this study predicts. Go to bp-dc.org/organic.

EU Committee of Parliament Calls for Stiffer Pesticide Restrictions

Members want overhaul and more precaution to protect health

DEBRA SIMES

After eight months of deliberation and discussion, the European Parliament's Special Committee (the PEST Committee) overwhelmingly approved its draft report in early December 2018 with recommendations to strengthen pesticide restrictions. PEST was established in January 2018 to assess the European Union's authorization procedure for pesticides. The group's charge was to review the European Union's (EU) pesticide authorization process, identify its failures in evaluating and approving pesticides and their use (including any conflicts of interest impacting the process), and make recommendations to improve the protection of human, animal, and environmental health from pesticides. The 30-member committee concluded: improvement of the system will require changes in the entirety of the pesticide approval process—from the point of industry application for authorization of a pesticide, to the sale and use of any products containing the compound in EU Member States, to evaluation of impacts of its use once on the market.

A CALL TO TIGHTEN REGULATION

The approval, sale, use, and regulation of what the EU calls "Plant Protection Products" [PPP]—active substances used to "1) to protect plants or plant products against pests/diseases, 2) to influence the life processes of plants (such as substances influencing their growth, excluding nutrients) and 3) to preserve plant products"—are controlled by the "PPP" Regulation. The regulatory process uses a two-step approach: active substances (the base chemical compounds) are approved at the EU level, and plant pesticides, or formulations, are authorized at the national, or Member State, level.

The convening and charge of this committee by the European Parliament (EP) was a response, in large part, to widespread pressure and considerable clamor from more than a million European citizens, and a number of NGO (non-governmental organization) advocacy and anti-toxics groups. Complaints sparked many months of controversy related to the compound glyphosate, the active ingredient in multiple herbicide formulations—most notably, Monsanto's (now Bayer's) Roundup—and, pointedly, related to Monsanto's undue and inappropriate influence on scientific studies that comprised the basis of much of the review process. The European Food Safety Authority (EFSA) reportedly copied dozens of pages from a Monsanto study in providing evidence for its conclusion that glyphosate is "unlikely to pose a carcinogenic hazard to humans." (EFSA's recommendation was supposed to provide an independent analysis for EU Member States when deciding to renew approval of the compound.)

The coalition Citizens for Science in Pesticide Regulation, comprising 120+ groups and institutions, sent an open letter to EU regulators in Member States, calling for reform of the pesticide authorization process and increased levels of protection. The letter charged that the current model of pesticide risk assessment is failing to protect people and the environment from the harm caused by these chemicals, and must be reformed.

In May of 2017, the European Union proposed a 10-year extension on the approved use of glyphosate-based compounds. Member States of the European Commission (EC) came up short in the EC's bids to approve 10- and 15-year extensions on the continued use of the compound, and in November issued a limited (five-year) extension for use.

The EC was holding out for further information on carcinogenicity, which was assessed by the European Chemicals Agency (ECHA), whose report was issued in March 2017; that assessment found that glyphosate is "unlikely to be carcinogenic." There is a stark disparity between the conclusions on glyphosate's potential carcinogenicity by the International Agency for Research on Cancer (IARC) of the World Health Organization and the EC and U.S. Environmental Protection Agency (EPA) official decision to the contrary.

DEFICIENICES IN EU PESTICIDE REGULATION

Among the many shortcomings of the EU's current pesticide approval system identified in the PEST Committee draft report are: involvement of the pesticide industry in the toxicity assessments of pesticides, misuse of the academic scientific literature, a lack of sensitive testing for neurological and other serious diseases, the lack of post-market monitoring data to assess the real impact of pesticides, and poor transparency of, and access to, the process for the public. The report calls out a multitude of specific failures of the existing process, such as: "the decision-making process has been found to be lacking in transparency throughout the procedure, from lack of public access to the full studies and raw data through to the risk management stage"; "national competent authorities involved in the approval and authorisation process are in some cases understaffed and underfunded"; and "there is currently no legal obligation to test active substances for their developmental neurotoxicity."

Recommendations by the PEST Committee are legion—72 of them, in fact—and constellate around those shortcomings and other issues. Importantly, the committee's product is a set of recommendations that *are not binding*. That said, they include calls for:

- heightened transparency across the entire pesticide assessment and approval process
- increased and "friendlier" public access to studies and data used in assessments
- equal weighting of scientific, peer-reviewed literature and lab-based studies
- use of data on final product formulations as part of assessment
- inclusion of key tests in risk assessment (e.g., current ecotoxicological tests for soil organisms, evaluation of environmental concentrations and residues in dust, wind, air, and water)
- a post-marketing monitoring system to enable assessment of the long-term effects on human and animal health, and the environment
- establishment of maximum residue levels for soils, using data collected through such post-market environmental monitoring
- completion and rapid implementation of cumulative risk assessments as part of the pesticide review process
- adoption of clear criteria for "unacceptable effects on the environment"
- inclusion of legally binding risk mitigation measures in approval of pesticides
- promotion of low-risk pesticides to help reduce adverse impacts of pest management
- use by risk managers of the Precautionary Principle in decision making on approvals of "active substances/plant protection products" (to include requisite conditions, and systematic communication about how this principle has been taken into account)

REGRETS FOR LONG DELAYS ON ACTIONS

Embedded in one recommendation is this retrospective comment: The European Parliament "regrets that the derogation by confirmatory data procedure has led to certain plant protection products that would have otherwise been banned to remain on the market for an extended period of time." This critique could readily be applied to the poor regulation of glyphosate—and any number of other pesticides—in the U.S., given long delays and phase-outs with the sell-off of existing stocks.

U.S. LAGS BEHIND EU IN ASSESSMENT AND APPROACH

Europe has generally been more proactive, precautionary, and protective of human and environmental health than has the U.S. Regulators, particularly at EPA, have faced similar concerns expressed by advocates, who see the need for a U.S. effort similar to the European Parliament's; there is certainly overlap in concerns between the EP's findings and critiques in the U.S. of the pesticide regulatory process. Advocates for human and environmental health have long pointed to a number of similar failings in U.S. regulatory processes, including transparency issues; "fox and henhouse" concerns (e.g., conflicts of interest in regulating bodies and processes), ecological and non-target harms, failure to evaluate impacts of final pesticide formulations, and inadequate environmental monitoring of pesticide use, not to mention repeated failures to follow the law.

In addition, EPA's general failure to use more-precautionary approaches in its evaluation of pesticides stands in contrast to the PEST Committee's recommendations. It likewise compares unfavorably with the recent decision of a French court to institute an immediate ban on the use of glyphosate, in which the court said that the French Agency for Food, Environmental and Occupational Health and Safety (ANSES) had not respected the precautionary principle in its consideration of the compound's potential health risks.

Sources: European Parliament, Draft Report, Special Committee on the Union's authorization, 9-17-18, favorable vote, 9-6=2018.

Precaution vs. Crisis

Early Warnings Unheeded Lead to Current Environmental Crises

JAY FELDMAN AND TERRY SHISTAR, PHD

The world is facing environmental crises that seriously threaten not only human health, but all life on earth. Scientists are discovering new links between agricultural chemicals and a host of "21st century diseases," including diabetes, obesity, food allergies, heart disease, antibiotic-resistant infections, cancer, asthma, autism, irritable bowel syndrome, multiple sclerosis, rheumatoid arthritis, celiac disease and inflammatory bowel disease—all of which are connected with disruption of gut microbiota. Dramatically, populations of insects—pollinators and others—are plummeting so fast that scientists fear they may disappear altogether, with disastrous effects on the global ecosystem and the life and economy it supports.

BLINDSIDED BY FAILED POLICY

A 2013 report, *Late Lessons from Early Warnings: Science, precaution, innovation*,[1] from the European Environment Agency (EEA) concluded that concerns raised by the scientific community on bee death, genetically engineered (GE) food, and nanotechnology support the need for a precautionary approach to public policy. Significantly, the report concludes that the "precautionary principle," whereby industry and policy makers take seriously early warnings about potential environmental impacts is "nearly always beneficial." The report features case studies on environmental impacts, such as mercury poisoning, effects on fertility caused by pesticides, and the impact of pharmaceuticals on some ecosystems, and raises questions about the potential wider impacts of GE crops, nanotechnology, nuclear power, and the effects of pesticides on pollinator populations.

The report lays the blame for numerous environmental crises squarely at the feet of corporations and policy makers who ignore early warnings about environmental impacts. "The historical case studies show that warnings were ignored or sidelined until damage to health and the environment was inevitable," the EEA said. EEA continues: "In some instances, companies put short-term profits ahead of public safety, either hiding or ignoring the evidence of risk. In others, scientists downplayed risks, sometimes under pressure from vested interests. Such lessons could help avoid harm from emerging technologies."

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THROWING PRECAUTION TO THE WIND—A FAILURE TO ANTICIPATE PROBLEMS

Without a mandate to follow the precautionary principle, U.S. regulation of pesticides has been susceptible to corporate hype about new technologies. Some prime examples are GE crops, nanotechnology, and systemic pesticides.

GE Foods: Unachieved Sustainability Claims

The EEA report finds that GE crops provide no direct benefit to consumers, are over-hyped, not necessarily safe, and are largely unsuitable for the great majority of the world's farmers. It argues that GE companies manipulate international patent and subsidy systems to gain maximum returns. "Modifying genotypes and capturing them as [intellectual property] through plant variety protection and patents is a far easier means of capturing financial benefits than attempting to [innovate] with cover crops, rotation schedules and composting, farmer-initiated training and education and small scale marketing and credit programs," the report says.

Nanotechnology: Lacking Full Safety Review

The EEA report points out that nanotechnology development has occurred in the absence of "clear design rules for chemists and materials developers on how to integrate health, safety, and environmental concerns into design." While the emerging area of "green nanotechnology" has a focus on preventive design, materials research must be funded at levels significant enough to identify early warnings and potential harms, and regulatory systems must provide incentives for safer and sustainable materials.

Systemic Insecticides: Failed Risk Assessments

Systemic insecticides, such as neonicotinoids, exemplify the failure to anticipate the full range of cascading ecosystem and public health effects. As public and regulatory pressure built to limit human exposure to toxic pesticides on farms and in surrounding communities, compounded by issues of insect and weed resistance, systemic pesticides were advanced as a chemical "solution" to the widespread pesticide exposure problem. Neonicotinoids are applied with a variety of methods, including foliar sprays, granules, soil drenches, tree injections, and, most commonly, coated seeds. With these application methods—and given the toxicity, longevity or persistence of these chemicals in soil and waterways, and indiscriminate poisoning—broad adverse ecological effects have been, and continue to be, documented.

Some European countries have suspended neonicotinoid seed "dressing" insecticides that are linked to bee decline. In Italy, following the ban, the number of reports of high mortality during spring decreased from 185 cases in 2008 to two cases in 2009. According to the EEA report, evidence of the toxicity of neonicotinoids highlights the major weaknesses of regulatory risk assessment and marketing authorization of pesticides.

PESTICIDE RISK MITIGATION MEASURES ADOPT FALSE ASSUMPTIONS

Faced with evidence of problems caused by pesticides, manufacturers and regulators have used a mitigation strategy to reduce risks. This strategy has been shown repeatedly to be unsuccessful.

Chlorpyrifos: The Power of Vested Interests

At one time one of the most widely used insecticides in the U.S. with 20 to 24 million pounds applied annually, the organophosphate insecticide chlorpyrifos has been linked to neurotoxic effects and thousands of pesticide poisoning incidents. In 2000, EPA and Dow AgroSciences reached an agreement to stop the sale of most home, lawn, and garden uses for chlorpyrifos because of its health risks to children, but allowed continued use in agriculture, for mosquito-borne disease control, and on golf courses. EPA, in 2017, reversed course onits proposal to ban food uses, given findings of adverse effects on children's brain development. Mitigation measures used risk assessment pseudoscience to reduce calculated numbers, while leaving children at risk.

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Antibiotics in Agriculture: Ignoring a Worldwide Crisis in Bacterial Resistance

The World Health Organization has called bacterial resistance "one of the biggest threats to global health, food security, and development today." As bacteria become resistant to the most commonly prescribed antibiotics, the results are longer-lasting infections, higher medical expenses, the need for more costly or hazardous medications, and the inability to treat life-threatening infections. The development and spread of antibiotic resistance is the inevitable effect of antibiotic use. Bacteria evolve quickly, and antibiotics provide strong selection pressure for those strains with genes for resistance. In spite of this crisis, EPA in 2018 approved two antibacterial chemicals, streptomycin and oxytetracycline, for use as pesticides in citrus production. Both antibiotics proposed for expanded use are important for fighting human disease. Preventive measures—such as those used in organic agriculture—should replace antibiotic use in crop and livestock production, where approximately 80% of antibiotics in the U.S. are used.

"Inerts," Mixtures, Metabolites, and Environmental Contamination

People encounter pesticides in combination with other chemicals. Whether it is on food, in water, or in the air, a pesticide active ingredient never occurs in isolation. First of all, it occurs with other chemicals in the formulation—so-called "inert" or " other" ingredients or formulants. Second, it is applied to a crop that has received applications of fertilizers and, perhaps, other pesticides. Third, these multiple chemicals break down at various rates, yielding a mixture of active ingredients, formulants, fertilizers, and their metabolites (breakdown compounds) on the crop. Finally, all of these chemicals wash off the field into surface waters where they join chemicals from other fields, sewage treatment plants, urban runoff, and industrial discharges. Those surface waters may recharge groundwater or serve as a source of drinking water. Fish and other animals live in the surface water and may be consumed by humans. Yet, pesticide products allowed on the market are only evaluated for their active ingredient(s).

Triclosan: High Hazard, No Benefit

Triclosan, one of the most prevalent antibacterial compounds in consumer products for decades, has been linked to a range of adverse health and environmental effects from skin irritation, endocrine disruption, bacterial and compounded antibiotic resistance, to the contamination of water and negative impacts on fragile aquatic ecosystems. Since being introduced in 1972 for use in hospital and health care settings, triclosan entered the marketplace in hundreds of consumer products, including antibacterial soaps, deodorants, toothpastes, cosmetics, fabrics, toys, and other household and personal care products—aided by the false public perception that antibacterial products best protect against potential harmful bacteria. Triclosan, while still in toothpaste and other products, after being pulled by manufacturers from liquid soaps and medical products

BOX 1

Federal and State Laws Filled With Loopholes

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) allows, on top of deficiencies in assessing pesticide hazards, numerous loopholes permitting increased untested pesticide use.

Emergency Pesticide Use Declared Despite Predictability

Relying on FIFRA Section 18, or emergency exemption provision, EPA allows the use of pesticides that are not registered for a particular crop, or not registered for use at all—adding to the toxic threat.

"Special Local Needs" Circumvent Law

FIFRA Section 24(c) allows states to approve new uses of a registered pesticide without examination of health and environmental effects associated with new use patterns.

Conditional and Experimental Use Exacerbates Weaknesses

Conditional registration allows pesticides on to the consumer market without all the required data to assess the chemical's safety—which has led to bee decline, tree death, and increases in human health risks. Under FIFRA Section 5, EPA may issue experimental use permits, though intended to facilitate the collection of data for pesticide registration, that have been used to expand the use of pesticides without notice.

Spraying of citrus with pesticides.

Utility companies generally use wood poles treated with toxic wood preservatives for distribution lines. Utilities expect poles to last 35 to 50 years, requiring the poison to be persistent.

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over the last several years, remains in plastics (toys, keyboards, hair brushes, cutting boards, etc.), clothing, and other consumer products. It has become the most prevalent contaminant not removed by typical wastewater treatment plants—being detected in wastewater, activated sludge, surface water, and sediments.

Wood Preservatives: Underexamined Hazards

Utility companies generally use wood poles treated with toxic wood preservatives for distribution lines. Since a wood pole is potentially a food source or living quarters for organisms, ranging from bacteria and fungi to insects and birds, it is treated with a broad-spectrum poison to protect it—despite the availability of alternative pole materials. Furthermore, utilities expect poles to last 35 to 50 years, requiring the poison to be persistent.

Wood preservatives are all toxic soups—complex combinations of chemicals, whose precise identity is generally unknown and present another example of the failure to address mixtures. An inadequate step at mitigating the risk of wood preservatives was taken when EPA accepted a voluntary cancellation of chromated copper arsenate wood preservatives for residential uses, including playground equipment, after decades of use. Pentachlorphenol, banned in more than 90 countries by international treaty, is still used in the U.S. for utility poles, railroad ties, and wharf pilings. Although creosote is not allowed for use in contact with food, feed, or drinking water, recycled creosote-treated railroad ties are frequently used for landscaping and in garden beds.

INADEQUATE PESTICIDE SAFETY LAW: SERIOUSLY UNPROTECTIVE

When determining the acceptability of pesticide use from a human health perspective, two issues emerge as particularly inadequate in the regulatory assessment: (i) the dramatic deficiency of evaluations that ignore the complex biological systems and exposure realities that must be considered to ensure good health, and (ii) the failure to consider the availability of less or nontoxic management systems for achieving pest management goals. The legal standard for registering a pesticide in the U.S. under the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA), which requires a determination of "no unreasonable adverse effects, taking into account the risks and benefits of pesticide use," illogically does not assess the essentiality of the pesticide use, including the availability of less toxic alternatives. In addition, the chemical-by-chemical approach used by EPA to assess the acceptability of a pesticide's hazards and its assumed benefits to society or pesticide users belies the critical scientific need to assess pesticide use in a broader context of exposure, pest management, and prevention. Key to an adequate assessment is always the question of whether there is an alternative to using the chemical that does not involve merely substituting a different chemical into the same management system.

Furthermore, EPA's human and ecological risk assessments suffer from a disconnect with practice in the real world. Risk assessments assume 100% compliance, with no real inspections on the farm. Non-target exposures through drift and runoff are not controlled, leading to exposures that cannot be calculated. Failure to catch violations in imported products leads to exposure to pesticides exceeding assumed levels or to prohibited chemicals. Additionally, nothing in the calculation of hazards evaluates the impact of pesticide and fertilizer reliance on fossil fuel or natural gas in their production process.

AN URGENT CALL FOR THE PRECAUTIONARY PRINCIPLE

The risk assessment-based federal pesticide law, and state laws that mimic it, must be replaced with a precautionary approach to using pesticide poisons that requires a mandated systems approach to pest prevention. As a part of this approach, least-toxic materials, with cradle-to-grave no adverse effects findings, are only allowed after conducting an alternatives assessment to determine essentiality. These allowed synthetic materials must come off the market on a five-year cycle—governed by a nongovernmental stakeholder body without conflict of interest—unless an objective, public, transparent process with scientific review and a needs assessment results in a super-majority vote to retain their use (a sunset process). This precautionary approach is currently integral to the *Organic Foods Production Act*. The precautionary principle establishes an approach that nurtures rather than kills life and harnesses the power and balance of natural systems, sometimes called ecosystem services.

1 European Environment Agency, 2013. *Late lessons from early warnings: science, precaution, innovation: Summary*. European Environment Agency. *http://wedocs.unep.org/bitstream/handle/20.500.11822/19260/Late_lessons_from_early_warnings_II_Summary.pdf?sequence=1&isAllowed=y*.

Reviewed by Jay Feldman

Elevating Outrage in the Fight Against Pesticides

The Fight Against Monsanto's Roundup: The Politics of Pesticides, Mitchel Cohen, New York, Skyhorse Publishing, 2019

Mitchel Cohen's book, *The Fight Against Monsanto* is a collection of essays from a range of scientists and activists, interspersed with his own critiques of the social, political, economic, and scientific dimensions of the pesticide threat. The analyses in the book drive the outrage that we all feel about the involuntary pesticide poisoning that has plagued our country with increasingly sophisticated and problematic biocides since World War II. Mr. Cohen brings an analysis of the social movements that have struggled against inequality and injustice and contextualizes pesticides as a symptom of vested economic interests that normalize practices harmful to the social good. With this analysis, he brings readers the thinking of 15 authors, including the forward by Vandana Shiva, the acclaimed international environmental and social justice leader.

Whether the reader agrees with Mr. Cohen's broad economic analysis, or even the science of a particular contributing author, the book is a forum for views that should spark debate and perhaps controversy. Having worked to tackle this problem for four decades, I have learned the value of hearing all viewpoints, whether they reinforce my worldview or criticize it. This comes after decades of studying the science on pesticides and pesticide policy, talking to regulators and legislators, listening to the victims of pesticide poisoning, discussing with farmers the damage caused by insect and weed resistance to pesticides, hearing the devastating experiences of beekeepers struggling to maintain the health of their hives, and watching the demise of species.

The author embraces the basic message and underlying science of Rachel Carson, when she writes in *Silent Spring* about the importance of protecting complex biological communities. He and contributors reject reductionist science that looks at "smaller and smaller isolated parts" which "more often than not hammers into place a *way* of examining the world that precludes the ability to see or understand the whole, and to construct a morality and sense of justice based on it." He continues, "One purpose of this book is to restore a more holistic vision that provides a framework for understanding the patterns beneath all the related "facts."

Mr. Cohen, a leader in New York City's No Spray Coalition, recounts a lawsuit that the coalition filed with Beyond Pesticides and other organizations in 2000 under the *Clean Water Act* after the city sprayed toxic insecticides over the city's waterways, contrary to the label, in its West Nile Virus spray program. After successfully settling the suit, and years later city officials were still asking the coalition, "Which less toxic chemical sprays should we use?" Mr. Cohen's answer: "None! Bring in goats, dragonflies, bats!" The author writes, "The use of natural predators of the so-called pests in question was to [officials] so far outside the boundaries of the dominant chemical mindset as to seem absurd."

When people rose up against the use of glyphosate in 2016, Mr. Cohen writes, "[G]oats were finally brought into the city from an upstate New York farm to feed on weeds in a fenced-off section of Prospect Park (Brooklyn). The goats chomped happily on the wild plants. Children got to see them "at work," and appreciated their new connection to nature. That section of the park was safely "weeded" in record time."

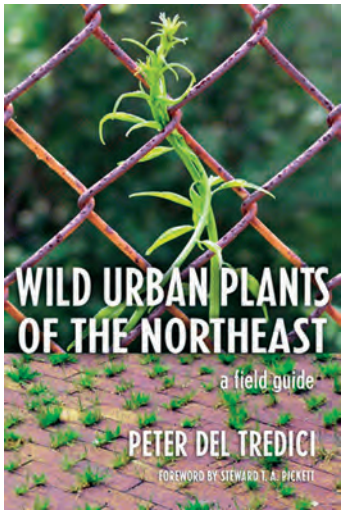
In capturing our outsized societal dependence on pesticides, corruption in the pesticide industry and government, and the failure of science to prevail over politics, this book adds to the call for urgent action.

Monsanto/Bayer's history looms large in the book, including controversy on company manipulation of scientific studies purported to be independent and the studies on Agent Orange, used in the Vietnam war. Stacy Malkin, with U.S. Right to Know, contributes a piece on the corporate influence of science coverage in the media, and how the truth came out. The book offers a wealth of citations in support of the critique. And, as a bonus, the book includes a chapter by the late Stephen Tvedten, who left the chemical pest control industry after he realized he poisoned himself and his customers. You'll have to read the book to find out, in Mr. Tvedten's words, "Why I Stopped Using Pesticide Poisons."

In capturing our outsized societal dependence on pesticides, corruption in the pesticide industry and government, and the failure of science to prevail over politics, this book adds to the call for urgent action. It certainly reinforces the immediate need to link science and activism in fighting the power of vested economic interests over public health and safety decisions, as we advance the changes required for a sustainable, regenerative, and just future.

Reviewed by Terry Shistar, PhD

Appreciating the Role and Ecological Function of Wild Urban Plants



Wild Urban Plants of the Northeast: A Field Guide, Peter del Tradici, PhD, Comstock Publishing Associates, a division of Cornell University Press, 2010

Urban areas, as constructs of civilized humans, are by definition highly disturbed environments, and cannot be managed according to standards applied to more pristine habitats. Cities provide vast areas of pavement, poor soils, and frequent severe disturbance—all of which provide challenges to native plants. *Wild Urban Plants of the Northeast* is primarily a field guide to 222 species of "spontaneous" plants found in cities within the area delineated by Montreal, Boston, Washington, DC, and Detroit, though the field guide would be equally useful in my town of Lawrence, Kansas. Just as important, however, is the introductory essay, which describes the ecology of urban plants.

The field guide is remarkable in several respects. The photographs offer several different views showing the plant at different stages of growth—including foliage, flowers, and seeds—and variations in growth habit. In addition to the standard plant characteristics, the description of each species offers short accounts of place of origin, germination and regeneration conditions, habitat preferences, ecological functions, cultural significance, and related species. According to the author, "The basic goal of *Wild Urban Plants* is to help the general reader identify the plants that grow spontaneously in the urban environment and develop an appreciation for the role they play in making our lives more livable." These plants comprise a large proportion of the "nature" encountered by the majority of people who live in cities. The field guide helps us to make connections to the food, medicine, and uses of spontaneous plants.

Urban landscapes in the Northeast include three broad categories of land: remnants of relatively undisturbed woodlands and wetlands dominated by native plants and requiring little maintenance, managed landscapes (e.g., parks and gardens) dominated by cultivated plants requiring moderate to intensive maintenance, and abandoned or neglected land dominated by spontaneous plants that require no maintenance.

The author of *Wild Urban Plants of the Northeast,* Peter Del Tredici, PhD, chooses to use the term "spontaneous plants" rather than the word "weeds," which is heavily laden with negative connotations. Spontaneous plants can live and reproduce without human intervention. Spontaneous plants in urban environments do so under conditions that would be adverse to native plants adapted to less harsh conditions. Stressors include paving that reflects and stores heat, producing higher temperatures, and that inhibits the movement of air and water into the soil; chemicals like salts and oils; poor drainage; soil compaction; and air pollution.

Abandoned or neglected land in cities ranges from sidewalk cracks to vacant lots. It is subject to unpredictable disturbance as buildings are torn down or constructed and infrastructure is replaced. Between such disturbances, ecological succession marks changes in plant species as pioneer plants change soil conditions for later colonizers.

The positive ecological functions provided by spontaneous plants in urban environments include reducing temperature, providing food and habitat for wildlife, erosion control, stream bank stabilization, and absorption of excess nutrient runoff. Some plants also help to clean up contaminated sites by selectively absorbing heavy metals. The author encourages readers to use spontaneous urban plants for landscaping. Recognizing that some of these spontaneous plants are elsewhere prized for their beauty, Dr. del Tradici offers suggestions for the "cosmopolitan urban meadow" to capitalize on the aesthetic and ecological virtues of spontaneous urban plants.

Finally, any debate about so-called "invasive" species in urban environments must take place in the context of the ecology of the highly disturbed urban landscape. *Wild Urban Plants of the Northeast* is an important addition to understanding that context.

The positive ecological functions provided by spontaneous plants in urban environments include reducing temperature, providing food and habitat for wildlife, erosion control, stream bank stabilization, and absorption of excess nutrient runoff.

SAFETY SOURCE

How do I find a pest management service provider who will use practices that will protect, and not poison, my family and me?

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Check out Beyond Pesticides' Safety Source for Pest Management (*bp-dc.org/safetysource*). The database is a constantly growing source of pest management service providers across the country who are utilizing practices that are sensitive to public health and environmental concerns—at least with some of their services.

Ask the right questions. Get the right answers. Though cost is an important issue when buying pest management services, the potential harm of products used is another critical issue to know about. The Safety Source directory requires that you, as the customer, ask some basic questions before you contract for services. If you're considering using a pest management company, make sure they complete the Safety Source survey at ***bp-dc.org/SafetySourceSurvey***.

Find a service provider that cares about your health at ***bp-dc.org/SafetySource***.

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MAKE YOUR YARD, LOCAL PARK, AND SCHOOL A "PESTICIDE FREE ZONE"

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Learn more at *www.beyondpesticides.org/lawns*.