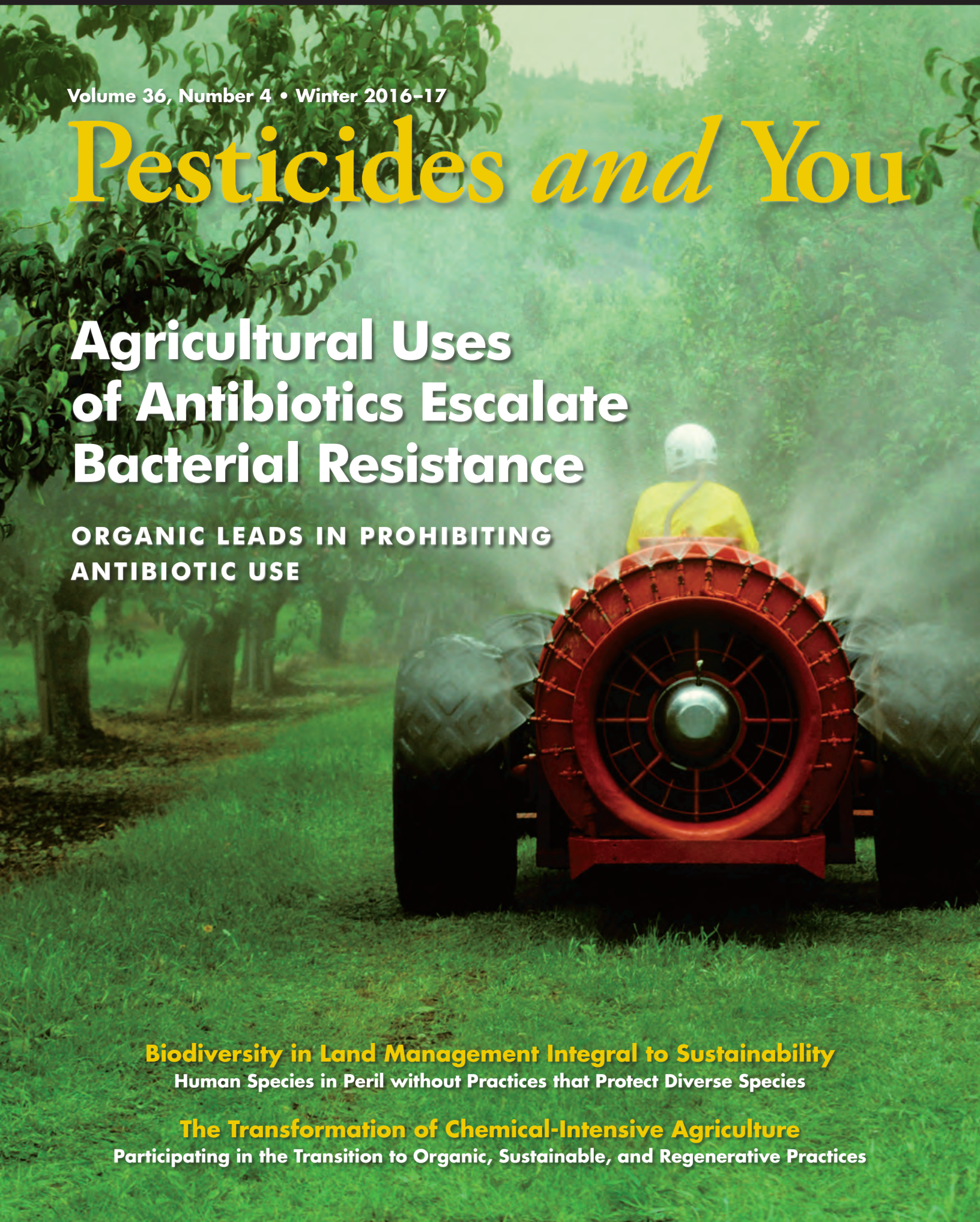
Beyond Pesticides: Protecting Health and the Environment with Science, Policy, and Action



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Pesticides *and* You

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From Farm to Family

Survival depends on the nurturing of diverse organisms from the soil up

This issue focuses on critical public health and environmental crises of the day that need urgent attention—the loss of biodiversity and bacterial resistance to antibiotics. Seemingly unrelated, both problems intersect with chemical-intensive agricultural and land management practices, affecting nearly 75% of total U.S. land area, including forests, pasture and rangeland, and cropland. Pesticide use wittingly or unwittingly targets biodiversity, and antibiotics, used in orchard and vegetable production in addition to livestock, contributes to bacterial resistance and disruption of microbiota in the human gut. In both cases, only the exponential expansion of organic practices offers an opportunity to prevent these problems. The Organic Foods Production Act (OFPA), requires protection of biodiversity, and its regulations prohibit the use of antibiotics.

Pesticides and antibiotic resistance

One of the most widely used herbicides, glyphosate (Roundup), is patented for its antibiotic properties and its use results in bacterial resistance to antibiotics that are used in fighting human pathogens. Many fungicides or bactericides, registered by the U.S. Environmental Protection Agency (EPA), are antibiotics.

While the residues of the antibiotics that show up in food at low levels are of concern and certainly contribute to bacterial resistance in humans, the resistant bacteria that emerge on chemical-intensive farms raise problems just as serious. Resistant bacteria move from farms to families, through the environment to the human population. Adding to the problem, the ability of antibiotics to disturb or kill the gut micro-biota in humans leads to autoimmune and other 21st century diseases.

Gut microbiota to the soil microbiome

How land is managed is interwoven with how the human body is managed. In fact, the way we manage biodiversity and the microbiome, including microbes and nutrients, in the soil has a direct relationship to the gut biome in humans. It has become increasingly clear that human survival depends on the nurturing of diverse organisms from the soil up.

There are growing concerns about soil health in agricultural systems dependent on toxic chemicals that kill indiscriminately. For example, the newest generation of systemic insecticides, neonicotinoids, has brought scientific attention to their adverse impact on pollinators and predatory species that offer ecosystem services in a balanced ecosystem. Studies are showing declines in a range of insects beyond the target insects. *A study, Meta-analysis reveals that seed-applied neonicotinoids and pyrethroids have similar negative effects on abundance of arthropod natural enemies*, published in December by Penn State researchers, found that plant seeds coated with insecticides, thought to be a way to reduce environmental contamination, adversely affect the health of beneficial predatory insects as much as broadcast applications of insecticides. In our piece on biodiversity, we highlight the work of the Wild Farm Alliance and its guide on biodiversity conservation practices for organic farmers and certifiers.

Transforming land management

The urgency of the environmental and public health problems that the nation and world face, calls for a transformation in the current chemical-intensive approach to land management. But the changes that are critically needed require a higher level of public involvement, much higher. Our piece on the National Organic Standards Board (NOSB) meeting this past Fall highlights the successes and challenges of the public-driven process used to determine acceptable standards and substances used in organic production. The foundation on which organic standards are set under OFPA will transform chemical-intensive agriculture, if we use the process. With an 11 percent growth in organic agricultural acreage in the last two years, there is constant pressure to relax oversight, standards, and even the underlying law. It will take a vigilant public protecting the values and principles of the organic law. The structure and process is in place to effect this transformation, so keeping the NOSB and the National Organic Program of the U.S. Department of Agriculture (USDA) accountable and compliant is key. Without public involvement, USDA and industry interests will limit the opportunities to effect broad change.

Natural lawsuits

Public awareness of environmental issues has grown. Still, there is confusion in the marketplace about best practices and purchases. Consumers read labels on food products and are misled by words like "natural" or "pure." This drives purchases away from organic, undercutting the framework for a meaningful solution. We will continue to ask: Is it responsibly grown, if it's not organic? Beyond Pesticides with others sued General Mills for labeling a product as natural, when it contains an ingredient grown with or containing residues of glyphosate (Roundup).

We are in the midst of a societal shift to organic, which must continue with accountability and increased urgency. Thanks to all those who contributed to Beyond Pesticides during our end-of-year appeal. Your support keeps our program of science, policy, and advocacy moving ahead.

Have a healthy new year!

Jay Feldman, executive director of Beyond Pesticides

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Apple orchard being sprayed with a pesticide.
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Safer Organic Lawn Care Does Cost Less

Beyond Pesticides,

I'm trying to work towards safer lawn care practices in my Homeowners Association, but I've run into problems with the board and administration that say that it's too expensive to transition to organic. Do you have any information that could help me make the case that the "cost" of organic lawn care won't break their bank?

Sheryl, Montgomery County, PA

Sheryl,

This is an argument used frequently to dismiss a common-sense change to organic and sustainable lawn care practices. While there is certainly a good amount of information that finds that a transition to safer methods is much cheaper in the long-term, start the conversation by reminding people why eliminating toxic pesticide use is essential in the first place. It is important to remember that the focus of pesticide reform is on public health. While the economic benefits of cosmetic pesticide use are concentrated within the chemical industry, the costs are often borne by individuals, particularly children, pregnant mothers, the chemically sensitive and others with compromised immune and nervous systems. Preventing or reducing the health costs associated with a childhood disease should be considered a benefit to the community. Given that there have been numerous localities that have successfully implemented organic land care practices, the community should strive to do the same, and act as a leader in the protection of public health, particularly children's health.

But if an appeal to the greater good doesn't make an impression, there are some well-respected sources to help you make your case. To start, look at the understanding the state of Connecticut has about organic lawn care. Its Department of Energy and Environmental Protection notes on its website, "If your lawn is currently chemically dependent, initially it may be more expensive to restore it. But in the long term, an organic lawn will actually cost you less money. Once established, an organic lawn uses less water and fertilizers, and requires less labor for mowing and maintenance." Other respected institutions back up this experience. Harvard University has a long-running lawn care program that was transitioned off of chemicals nearly a decade ago, and the school wisely documented the economics of its transition. Harvard indicates that it was able to reduce irrigation needs by 30%, saving two million gallons of water a year as a result of reduced demand. The school was also spending $35,000/year trucking yard waste off site. Harvard can now use those materials for composting and save an additional $10,000/year due to the decreased cost and need to purchase fertilizer from off-campus sources.

Beyond Pesticides' Board Member and nationally renowned turfgrass expert Chip Osborne conducted a study several years ago (see: *bit.ly/turfcosts*) that compares the costs of

SHARE WITH US!

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

conventional and organic turf management on school athletic fields. The report concludes that, once established, a natural turf management program can result in savings of greater than 25% compared to a conventional turf program. This report was conducted in 2010, and since then there have been significant improvements in organic-compatible products that help speed organic transitions.

Seeing how cost issues play out at the community level can also be helpful. As part of Reno, Nevada's pilot pesticide-free parks program, the city estimated that there would be no additional expenses to transition off of pesticide use. City staff stated in a report, "There are no cost implications as staff will implement changes within its adopted budget." The city estimated it spends approximately 1.4% of total maintenance time applying herbicides, and 4.1% of time using manual or mechanical weed control alternatives. To implement the program, the Park's Department discontinued herbicide use and began to implement alternative strategies that include the use of organic products, burning, or additional manual or mechanical weed control. The City did not expect the total time spent on weed control to differ as a result of the change in practices.

We hope this information will help you make the case that alternatives to pesticides aren't only the right thing to do for public health, but the most cost-effective move to make in the long-term.

Endocrine What?

Beyond Pesticides,

I'm a new parent, and I've recently heard other parents talking about how bad "endocrine disrupting chemicals" are, but I have to admit I don't know what they are. Can you explain it briefly?

Jane, Springfield, IL

Jane,

Endocrine disrupting chemicals (EDCs) are defined as any substance or mixture that alters the function of the endocrine (hormonal) system, and consequently results in adverse effects. A wide range of EDCs are pesticides, but other industrial chemicals, such as arsenic, phalalates and bisphenol A (found in many plastics), also exhibit hormone disrupting properties. EDCs reveal that classical toxicology, the concept that "the dose makes the poison," is outdated. Rather than showing increased adverse effects as the amount of exposure to an EDC increases, the latest science finds, in fact, that infinitesimal amounts of exposure to EDCs can result in the greatest adverse health impacts. This is a particularly troubling issue for pregnant mothers, infants, and young children, as scientists have determined that there are "critical windows of development" (see TEDX, The Endocrine Disruption Exchange: *bit.ly/criticalwindow*) in a child's life where low-dose exposure to EDCs can have profound impacts on health later in life.

In the U.S., under a law passed by Congress in 1996, known as the Food Quality Protection Act, the Environmental Protection Agency (EPA) is required to create a regulatory framework for evaluating and regulating EDCs. Twenty years later, EPA has only now begun to screen chemicals for endocrine disrupting properties. However, the agency effort has been heavily criticized for not keeping pace with advancing science because it does not adequately evaluate the potential for low-dose effects. For help preventing your child's exposure to these harmful chemicals, start with Beyond Pesticides' website on important information for new moms and dads here: *bit.ly/imptparentinfo*.

We hope you'll continue to educate yourself and other new parents about the dangers these chemicals pose, and advocate for changes that eliminate unnecessary use of endocrine disrupting pesticides and other chemicals.

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' original blog post (11/30/2016): Industry Challenges Local Maryland Restrictions of Lawn Pesticides as Preempted by State. A landmark Montgomery County, Maryland ordinance, which protects children, pets, wildlife, and the wider environment from the hazards of unnecessary lawn and landscape pesticide use, is facing a legal challenge filed last week by the industry group Responsible Industry for a Sound Environment (RISE).

Safe Grow Montgomery comments:
Thanks Beyond Pesticides. We're not going away and plan to stand up to the pesticide industry on this lawsuit to protect our families and communities. Residents in Montgomery County can help by getting on our mailing list as we prepare for next steps, email: *info@safegrowmontgomery.org*.

Maxin P. comments:
Don't you think protecting children, pets, wildlife and the wider environment are as important as points of law? The point to me is that the industry responsible for producing lawn pesticides is fighting to be able to continue using and producing poisons.

Lawsuit Challenges "Pure" and "Natural" Label on Honey Contaminated with Glyphosate

A November 2016 lawsuit filed in Superior Court in the District of Columbia challenges Sioux Honey Association for deceptively labeling its Sue Bee and Aunt Sue's honey brands "pure" and "natural" because they contain residues of the toxic weed killer glyphosate. The suit, filed by Beyond Pesticides and Organic Consumers Association (OCA), follows news that Sue Bee honey products labeled "100% Pure" and "Natural" tested positive for glyphosate residue. Glyphosate, an endocrine disruptor and, according to the World Health Organization, a probable human carcinogen, is the active ingredient in Monsanto's Roundup herbicide.

"We join and support those beekeepers who are working to stop hazardous pesticide uses that cause widespread contamination of crops, including honey," said Jay Feldman, executive director of Beyond Pesticides. He continued, "Until U.S. or state regulatory agencies prohibit Monsanto and other manufacturers of glyphosate from selling pesticides that end up in the food supply, we need to protect consumers by demanding truth and transparency in labeling." The suit argues that the words natural and pure be removed from the product label.

"A consumer seeing the words 'Pure,' '100% Pure,' or 'Natural' on a honey product would reasonably expect that product to contain nothing other than honey," said OCA International Director Ronnie Cummins. "Regardless of how these products came to be contaminated, Sioux Honey has an obligation to either prevent the contamination, disclose the contamination, or at the very least, remove these deceptive labels," Mr. Cummins said.

The U.S. Environmental Protection Agency (EPA) has not set a tolerance (or acceptable level) for glyphosate in honey, raising questions about the legality of any level. EPA was supposed to rule in 2015 on whether or not to re-register glyphosate, but has failed to complete the review process on schedule. In the meantime, in the absence of federal or state action to ban glyphosate, the best way to keep glyphosate out of the environment is to buy food and drinks labeled as certified organic and adopt organic community land management programs.

EPA Allows Expansion of Hazardous Herbicide Use in Genetically Engineered Crops

In the face of growing weed resistance to Roundup (glyphosate) in genetically engineered crops, the U.S. Environmental Protection Agency (EPA) has registered a new formulation of the weed killer dicamba in cotton and soybean crops, genetically engineered (GE) to tolerate the new chemical formulation. The product, called Xtendimax with Vapor Grip Technology, is claimed to be specifically designed to have low volatility because of a history of damage caused by chemical drift. The registration will automatically expire after two years. According to the Center for Biological Diversity, in registering the chemical for this use, EPA ignored the legal requirement to explore threats to endangered species under the Endangered Species Act. This decision follows EPA's announcement that it is reapproving the toxic herbicide mixture Enlist Duo (2,4-D and glyphosate), and proposed to expand the number of crops and states in which it can be used.

After withdrawing its January 2016 registration approval for Enlist Duo use in GE crops, EPA announced in January 2017 that it is not only reapproving the chemical combination, but it is expanding the number of crop uses and states in which it can be applied. The expanded registration will allow the use of Enlist Duo on GE cotton and extend use to GE corn, soybeans, and cotton from 15 to 34 states. This follows an EPA review triggered by manufacturer claims on its patent that Enlist Duo ingredients have synergistic effects, which EPA had not evaluated. According to EPA, its latest review of the data found no synergistic effects.

Both of these herbicides, used with GE crops, are formulated with glyphosate, which the International Agency for Research on Cancer (IARC) identified as carcinogenic to humans based on laboratory animal studies. Dicamba has been linked to damage of the kidney and liver, neurotoxicity, and developmental impacts. 2,4-D has been linked to soft tissue sarcoma, non-Hodgkin's lymphoma (NHL), neurotoxicity, kidney/liver damage, and harm to the reproductive system.

By Killing Beneficial Insects, Neonic-Coated Seeds Increase Pesticide Dependency

A recent meta-analysis has challenged the industry claim that neonicotinoid (neonic) insecticide seed coatings have little to no effect on the health of beneficial predatory insect populations. On the contrary, researchers have found that the seed coatings adversely affect predatory insects as much as broadcast applications of applied insecticides. The study, authored by Margaret Douglas, PhD and John Tooker, PhD, of Penn State University, confirms previous work on this subject, finding that the seed coatings are detrimental to organisms through secondary poisoning (caused by a healthy organism preying on one that is contaminated).

The researchers compiled data sets that compare predatory insect abundance in plots that are planted with coated seeds to control plots, which are either managed without insecticides or with pyrethroid insecticides. The population of predatory insects is reduced in the plots where coated seeds are planted, compared to the plots not treated with insecticides. The coated seed trials reduce predatory insect populations at a rate similar to soil and broadcast applications of pyrethroids.

In an earlier study, Dr. Douglas found that seed treatments using the neonicotinoid thiamethoxam, a toxic insecticide used to control pest slugs, instead bioaccumulate and then transfer through the slugs into their insect predators, impairing or killing more than 60%. This results in crop loss due to a decline in beneficial insect predators and an increase in the slug population.

Generally, these findings indicate that the use of neonicotinoid-coated seeds, which are marketed as reducing pesticide use, actually increases the necessity of toxic chemicals by killing off natural, beneficial insect predators. With these findings, the researchers conclude that the coated seeds only perpetuate the dangerous cycle of escalating pesticide use, or the pesticide treadmill.

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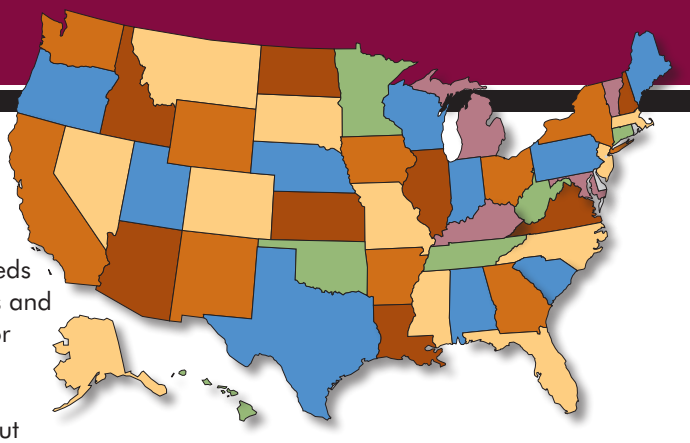
Monsanto's Glyphosate Found in Food as EPA Panel Reviews Hazards

The Food and Drug Administration (FDA) in mid-November suspended testing for glyphosate residues in food amid difficulties establishing a standard methodology to use across the agency's multiple U.S. laboratories. The suspension was announced just as a report was released from Food Democracy Now! and the Detox Project that exposes dangerous levels of glyphosate contamination in popular U.S. foods. Glyphosate has been found to cause changes to DNA functioning, resulting in chronic disease, and has been classified as a probable carcinogen by the International Agency for Research on Cancer (IARC).

The report, *Glyphosate: Unsafe on Any Plate*, found high levels of glyphosate contamination in popular food brands, such as Cheerios, Doritos, Oreos, Goldfish and Ritz Crackers, and Stacy's Pita Chips. According to the report, the levels found in these products are above the levels associated with organ damage (above 0.1 parts per billion (ppb)). Among 29 different foods tested, the highest levels detected are found in General Mills' Original Cheerios, at 1,125.3 ppb. Stacy's Simply Naked Pita Chips are the next highest, at 812.53 ppb. The testing and analysis was performed by Anresco Laboratories, which is an FDA registered laboratory.

Then, in late December, a long-awaited and contentious scientific meeting convened by the U.S. Environmental Protection Agency (EPA) on the carcinogenic properties of glyphosate wrapped up its review, with the 15-member scientific advisory panel split on its determination, as some members consider a "suggestive evidence" classification. The panel's charge is to evaluate EPA's recent proposal that the widely used herbicide should be considered "not likely to be carcinogenic to humans," despite IARC's determination. Following the close of the meeting, the panel has roughly three months to provide a recommendation to the agency, which is likely to influence EPA's final cancer classification of the herbicide.



Similar to Other States, Delaware Pollinator Protection Plan Protects Bee-Toxic Pesticides

In early December 2016, the Delaware Department of Agriculture (DDA) released its Managed Pollinator Protection Plan, which allows for the continued widespread pesticide use across the state's landscapes. The plan includes voluntary strategies for farmers, beekeepers, landowners and pesticide applicators, but fails to include any recommendations for reducing or eliminating bee-toxic pesticide use.

Like other state pollinator protection plans, there is little mention of pesticides, despite the fact that neonicotinoids (neonics) are highly toxic, persistent, and systemic pesticides that have been widely implicated as a leading factor in pollinator decline. According to environmentalists and beekeepers, little meaningful action has been taken to address pesticide impacts on pollinators, and industry groups have been working to weaken and derail pesticide reforms at the state and local level that may protect pollinators.

A major component of Delaware's plan is the creation and maintenance of habitat and forage for pollinators. It states that, "It is important to consider diversity when choosing plants to ensure adequate forage for the entire growing season." The plan continues, "Diversity will also ensure pollinators have access to all of the nutrients they require to be healthy."

Insecticide and fungicide-coated seeds are the most popular method of controlling target insects or fungal diseases in chemical-intensive agriculture and landscaping, accounting for the vast majority of seeds for major crops and ornamental plants in the U.S. However, coated seeds result in the poisoning of nectar, pollen, and guttation droplets and indiscriminate poisoning of pollinating and foraging organisms. The sourcing of seeds not coated with toxic pesticides and the plants needed for pollinator nutrition is absent from DDA's plan, a problem that is shared by the other state plans. Without restrictions on the use of neonics, pollinator habitat and forage areas are at risk for pesticide contamination and provide no real safe-haven for bees and other pollinators.

State Attorneys General Join Fight to Stop Agrichemical Industry Mergers

Seven state attorneys general (AGs) have joined together to investigate federal antitrust concerns related to the merger of agrichemcial giants Dow Chemical and DuPont. A separate group of state AGs is expected to form to simultaneously probe a similar merger between Bayer and Monsanto. This involvement signals grave concern from states over the prospect of these large-scale mergers, which will concentrate control in fewer companies, thus giving great marketplace power to a smaller number of chemical manufacturers in the agrichemical industry.

The discussion on these mergers began back in December 2015 when chemical giants DuPont and Dow Chemical companies announced that their boards of directors unanimously approved a merger of their companies, valuing the combined market capitalization at $130 billion. Then, in September 2016, Bayer AG made a final bid for Monsanto, resulting in a merger agreement worth $66 billion. A third industry merger between China National Chemical Corp. and Syngenta AG is also in the works, having received the go-ahead from the Committee on Foreign Investment in the U.S. (CFIUS). However, the Chem-China-Syngenta merger is unlikely to be investigated by state AGs, since it does not involve a U.S. company.

The consolidation of these large players has raised concern for dozens of reasons. Advocates say that not only do the proposed mergers likely violate U.S. antitrust law, they also pose significant potential threats to U.S. security interests, undermine food security in the U.S. and worldwide, disrupt trade flows, and accelerate the international consolidation of the food and agribusiness industries and political power to the detriment of American farmers, rural communities, and consumers. It is estimated that if all the deals were to close,

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the three resulting companies would control nearly 70 percent of the world's pesticide market and 80 percent of the U.S. corn-seed market, a troubling statistic for anyone concerned about the impact chemical-intensive agriculture has on soil quality and overall environmental health.

Court Knocks Down Local Pesticide Restrictions on Private Property in Hawaii, Upholds Restrictions on GE Crops

The 9th U.S. Circuit Court of Appeals in late November 2016 struck down local county laws aimed at protecting residents' health and the environment in Hawaii. The ruling, handed down by federal Circuit Judge Consuelo M. Callahan, finds that Hawaii state law is comprehensive in regulating pesticides, and "impliedly preempts" local jurisdictions from passing laws with stricter standards than the state's. The decision represents a victory for Monsanto, Syngenta, and the agrichemical industry, and a blow to the efforts of grassroots activists, who point to Hawaii as "ground zero" for toxic and experimental pesticide and genetically engineered (GE) crop use.

Judge Callahan's ruling overturns a number of laws passed over the last several years on different Hawaiian Islands that seek to protect residents, the environment, and organic farms from the toxic effects of pesticide use and drift from GE cropland. This includes Bill 2491, a measure in Kauai County that imposed common-sense buffer zones for pesticide use within 500 feet of schools and medical facilities, and within 100 feet of any park, public roadway, or shoreline that flows into the ocean. Also invalidated is Hawaii County's Bill 113, which bans the production of GE crops in open-air conditions, carving out exceptions for crops that were already growing on the island. And, stopped in its tracks in Maui County is a citizen initiative and lawsuit that defended a successful ballot initiative, which created buffer zones and temporarily banned GE crops from being planted on the island.

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Pineapple field in Hawaii.

Localities across the country are pushing forward with pesticide reform because of mounting evidence that federal and state authorities are not doing enough to protect them and their communities. Advocates are concerned that state and federal leaders fail to adopt laws and regulations that respond to the latest science and enforce existing laws.

EPA Fines Syngenta $4.8 Million for Illegal Pesticide Use, Terminex and Monsanto Investigated

Since states have responsibility for enforcing federal pesticide law, there is often a question as to whether there is adequate oversight of highly toxic pesticide use, especially when agriculture departments have the authority. The Environmental Protection Agency (EPA) has been warning the Hawaii Department of Agriculture (HDOA) repeatedly since 2012 that it has failed to adequately enforce pesticide laws and has allowed an unacceptable backlog of inspection files to grow. Instead of increasing its enforcement staff, like other states, HDOA enforcement capacity has been steadily shrinking, and the number of inspections and enforcement actions have been decreasing every year.

In December 2016, EPA filed a complaint against a Syngenta research farm in Kauai, Hawaii for exposing a dozen agricultural workers to an unregistered insecticide on the farm in early 2016. Syngenta Seeds, LLC is facing over $4.8 million in fines from EPA for allegedly violating multiple federal pesticide regulations meant to protect agricultural workers. At the time of the incident, 19 agricultural workers went to work on fields freshly sprayed with the insecticide chlorpyrifos, a highly neurotoxic organophosphate insecticide that was banned for residential use in 2000 but left in place for most agricultural use. The incident sent 10 workers to the hospital for medical treatment related to their exposure.

In November 2016, EPA began an investigation of Monsanto and home pest control giant Terminix for pesticide law violations in Hawaii. According to Scott Enright, director of HDOA, the Terminix case was referred to EPA because the complaint included multiple allegations.

The Terminix investigation stems from an April 2016 employee complaint claiming that workers lacked the proper equipment for fumigations and that their self-contained breathing apparatus were not filled with air. Employees also allegedly do not use scales to weigh fumigants and are not equipped with clearing devices, which determine whether buildings are safe to enter. Less is known about the Monsanto case referred by Hawaii to EPA. However, the use of agricultural pesticides, particularly by large seed companies, continues to be a contentious issue in Hawaii.

Industry Challenges Local Maryland Restrictions of Lawn Pesticides as Preempted by State

A landmark Montgomery County, Maryland ordinance, which protects children, pets, wildlife, and the wider environment from the hazards of unnecessary lawn and landscape pesticide use, is facing a legal challenge filed in November 2016 by the industry group Responsible Industry for a Sound Environment (RISE). The plaintiffs, which include local chemical lawn care companies and a few individuals, allege that the local ordinance is preempted by state law, despite the fact that Maryland is one of seven states that has not explicitly taken away (or preempted) local authority to restrict pesticides more stringently than the state.

The bill at issue, 52-14, which bans cosmetic, or aesthetic, lawn care use of toxic pesticides on public and private land, protects over one million people, the largest population to be covered by any local jurisdiction to-date. An industry victory in Maryland state court would prohibit local communities in Maryland from exercising their democratic right to adopt local public health and environmental protections by restricting pesticide use on private property because of its off-target effects on community air and water, as well as drift and runoff on neighboring property. The portion of the Montgomery County law that restricts pesticides on public property is not in dispute.

During the original debate on the bill, Montgomery County City Council legislative attorney Josh Hamlin wrote a memo on the issue of preemption. In it, he asserts that while a court could conclude that Montgomery County is preempted, that conclusion is far from certain, given that both Maryland case law and legislative history make a strong argument against implied preemption. While plaintiffs may look to other states, specifically the decision regarding local pesticide restrictions in Hawaii, to strengthen their argument in favor of implied preemption, those cases must be viewed in the context of the specific state legislation, legislative history, and case law.

While the outcome of the lawsuit is currently uncertain, the case highlights the importance of local action when it comes to tightening controls on cosmetic pesticide use on both public and private property—especially in the absence of adequate restrictions at the state and federal level.

Health Canada Proposes to Ban Most Uses of the Bee-Toxic Insecticide Imidacloprid

In late November 2016, Health Canada announced its intent to cancel nearly all uses of the neonicotinoid insecticide imidacloprid, after determining that the chemical poses unacceptable risks to the environment. Although imidacloprid and other pesticides in the neonicotinoid chemical class are harmful to pollinators, Health Canada's decision to eliminate most uses of the chemical is based primarily on the danger it poses to aquatic insects. Environmental groups are praising the proposal, but cautioning against the long, three to five year phaseout period proposed by the agency. Advocates are urging the U.S. Environmental Protection Agency (EPA) to complete its full assessment of imidacloprid and follow Canada's lead in eliminating this toxic chemical.

Health Canada is proposing to eliminate the following uses of imidacloprid:

- trees (except when applied as a tree trunk injection)
- greenhouse uses
- outdoor agricultural uses (including ornamentals)
- commercial seed treatment uses
- turf (such as lawns, golf courses, and sod farms)
- residential lawns

However, the agency is leaving in place certain uses for the chemical, including applications in and around homes and buildings, and flea, tick, and lice collars for cats and dogs. It is also important to note that this current proposal is only specific to imidacloprid, and does not address the use of other neonicotinoids or systemic chemicals. Health Canada's review also does not incorporate the impact imidacloprid poses to honey bees.

Although EPA has yet to release as broad a health and environmental review as Health Canada, it did release an assessment of imidacloprid's risk to honey bees in 2016. The agency's work confirms that the chemical is highly toxic to honey bees, and that bees can be exposed to harmful residues of the chemical in crops where pollinators forage, including citrus, cotton, and other crops.

Agricultural Uses of Antibiotics Escalate Bacterial Resistance

ORGANIC LEADS IN PROHIBITING ANTIBIOTIC USE

TERRY SHISTAR, PH.D. AND CARLA CURLE

With the explosion of antibiotic resistance in the U.S. and worldwide, antibiotic use in crop and livestock production is a major public health issue. Regulation of the use of antibiotics in chemical-intensive agriculture is weak, allowing residues of antibiotics and antibiotic-resistant bacteria to emerge on agricultural lands, move through the environment, contaminate waterways, and ultimately reach consumers in food. The human gut and contaminated land and waterways provide incubators for antibiotic resistance. The main health impacts of antibiotic residues in food are the promotion of antibiotic resistance and disruption of the microbiota in the human gut.

Antibiotic use has been prohibited in organic animal agriculture since the promulgation of the organic rule in 2000. The use for control of fire blight (whose name is derived from the black shoots and leaves caused by a bacterial infection) in apples and pears was removed from the allowed list of materials by decisions of the National Organic Standards Board (NOSB) in 2013 and 2014. Although consumers can avoid antibiotic residues in their food supply by buying organic, more stringent regulation is needed to eliminate antibiotic use in agriculture and the breeding of antibiotic resistance in the environment.

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Antibiotic Use in Animal Agriculture

The use of antibiotics in animal agriculture has received a great deal of attention—and rightly so. Most traditional antibiotic use occurs in the production of livestock and animal products. Because the antibiotics pass through the animal and end up in poorly-managed manure, animal agriculture is a major source of environmental contamination with antibiotics and antibiotic-resistant bacteria. According to Physicians for Social Responsibility, in 2011, 29.9 million pounds of antibiotics were sold for cattle and poultry production, compared to 7.7 million pounds of antibiotics for sick humans. Of the antibiotics used in animal production, 90% were administered at low levels to animals through feed and water to prevent disease and promote growth in order to compensate for overcrowded and unsanitary living conditions in concentrated animal feeding operations (CAFOs), used by the industry to fatten livestock quickly on their way to market. Although the U.S. Food and Drug Administration's (FDA) Veterinary Feed Directive, which took effect in January 2017, will now limit the use of medically important antibiotics for humans to therapeutic use only with the oversight of a veterinarian, significant loopholes for continued antibiotic use remain. (The regulatory section provides details.) Antibiotic use is prohibited in all organic production. While organic standards require that sick animals be treated, meat and other products from animals treated with antibiotics cannot be sold as organic.

Treated Animals Contaminate Manure

Antibiotic residues are carried over into manure, which is then applied to crops that would otherwise not be exposed to antibiotics, including organic crops. Such residues may be taken up by crops. While conventional agriculture has no restriction on the use of manure, organic standards require that, if used on crops for human consumption, it must be either composted or incorporated into the soil 90–120 days before harvest, which may reduce concentrations of some antibiotics and populations of antibiotic-resistant microbes. More research on this is needed.

While the use of antibiotics in animal agriculture is widely acknowledged as harmful, the use of antibiotics in chemical-intensive crop production also poses unnecessary risks. Glyphosate, while marketed as a weed killer, is patented by its manufacturer, Monsanto, as an antibiotic. It is the most widely used antibiotic in agriculture—attacking the shikimate pathway, part of the mechanism for producing certain amino acids in both plants and microbes.

FIGURE 1: **Traditional Antibiotic Uses* in 2011–U.S.**
(pounds of active ingredients)

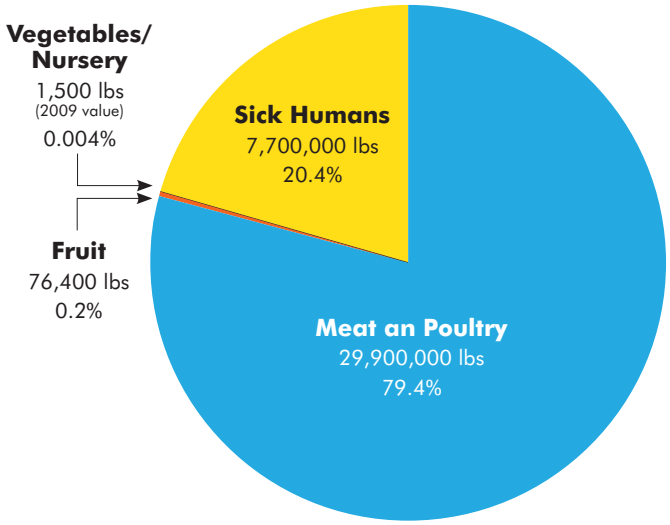
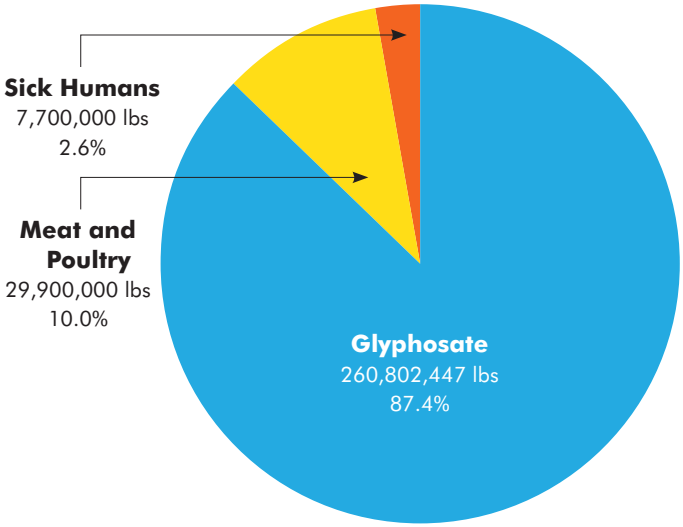


FIGURE 2: **All Antibiotic Uses* in 2011–U.S.**
(pounds of active ingredients)



Sources: IMS Health Inc., U.S. FDA, and USDA NASS.

* "Traditional antibiotic use" is used in this report to refer to uses in animal agriculture and the antimicrobial pesticide uses, while "all antibiotics" includes glyphosate.

Note: Aquaculture not included because such use has not been monitored.

In addition to the promotion of weed resistance by widespread application of glyphosate and use of glyphosate-resistant genes in agriculture, there is evidence that glyphosate at environmentally relevant levels increases bacterial resistance to antibiotics important in fighting human pathogens and bacterial infections (Kurenbach et al., 2015).

Additionally, fungicide use and labeling overlap with antibacterial use. It is not clear to what extent these fungicides are effective as antibiotics and contribute to the problem of antibiotic resistance.

Antibiotics in Fruit and Vegetable Production

Use of traditional antibiotics in fruit and vegetable production is limited in the U.S. to the antibiotics oxytetracycline and streptomycin. Allowed residues, or tolerances, for the antibiotics are set at 0.35 ppm oxytetracycline in or on apples, pears, and peaches (including nectarines), and 0.25 ppm streptomycin in apples and pears in the finished fruit that is purchased in grocery stores. (See Table 2.) Although fruit production only accounts for 0.2% of total domestic traditional antibiotic use, the majority of conventional apple and pear producers use antibiotics, as fruit growers have moved to varieties less resistant to fire blight, a highly contagious and destructive bacterium. In 2011 in California, 45% of apple acres were treated with streptomycin and 29% were treated with oxytetracycline. In the same year in California, 65% of pears were treated with streptomycin and 80% were treated with oxytetracycline (USDA NASS, 2012). A smaller proportion of peach and nectarine trees are treated with oxytetracycline for bacterial spot.

Alternatives to antibiotics to combat fire blight in apples and pears were examined in depth by the NOSB, when it rejected the use of tetracycline and streptomycin in organic fruit production. The first line of defense for fire blight is choosing resistant varieties and rootstocks. Highly resistant apple varieties include Jonafree, Melrose, Prima, and Quinte. Fire blight resistant pear varieties include the Atlantic Queen, Ayers, and Seckel varieties. Other practices for avoiding fire blight in apples include balancing nutrients and avoiding over-application of nitrogen fertilizers, avoidance of over-pruning in the dormant season, use of copper materials on the trees between delayed dormant and tight cluster stages as preventive measures against overwintering of disease, and use of lime sulfur during bloom, with some slight differences for pears. In addition to these methods, considering how changes in the orchard environment have contributed to epidemics of fire blight is important for orchard managers. In response, fruit producers can increase species diversity and decrease tree density, use resistant cultivars and rootstocks, and plant a variety of cultivars on a variety of rootstocks (Steiner, 2000). The elimination of antibiotic use in organic apple and pear production demonstrates that antibiotics are not needed for fruit production.

There are several registered uses for streptomycin in vegetable and seedling production, but there are no registered uses for oxytetracycline in vegetable production domestically. In addition to these uses for food crops, streptomycin is used in nursery and floriculture production, according to the U.S. Department of Agriculture's (USDA) National Agricultural Statistics Service (NASS), with 1,400 pounds applied in 2009.

TABLE 1: **Use of Antibiotics on Fruit in the U.S. in 2015 according to USDA NASS** (www.nass.usda.gov)

	Streptomycin				Oxytetracycline			
Crop	Percentage of Acres Treated	Acres Treated	Pounds per Acre per year	Total Active Ingredient Per year (lb)	Percentage of Acres Treated	Acres Treated	Pounds per Acre Per Year	Total Active Ingredient Per year (lb)
Apple	26	68,581	0.49	33,600	11	30,000	0.27	8,100
Pear	16	7,346	0.39	2,900	30	14,200	0.5	7,100
Peaches					5	4,103	0.39	1,600
Total				**36,500**				**16,800**

TABLE 2: **Tolerances for Residues on Foods in U.S.** (parts per million)

	Apples, Peaches, Pears	Beans	Celery	Pepper	Tomato	Potato
Streptomycin	0.25	0.5	0.25	0.25	0.25	0.25
Oxytetracycline	0.35	–	–	–	–	–

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Fungicides Used as Antibiotics

The universe of "traditional antibiotics" used to manage bacterial plant diseases is larger than generally recognized. Bacterial diseases on tree fruit include fire blight, bacterial spots, and bacterial cankers, for which tetracycline and streptomycin are registered as fungicides or bactericides, as controls. Vegetable crops, such as potatoes, tomatoes, peppers, and beans, are also vulnerable to bacterial diseases, including but not limited to bacterial canker, soft rot, and bacterial wilt. Although the only product generally called an "antibiotic" that is registered for bacterial diseases in U.S. vegetable production is streptomycin, several "fungicides" are registered for managing bacterial diseases in fruits, vegetables, grains, and other food crops. These fungicides include biologics, a number of copper compounds, inorganic oxidizers, growth regulators, and fungicides from several chemical classes. The use data is not available to separate the antibiotic uses of these materials from the fungicidal uses, but their inclusion in the totals would increase considerably the total antibiotic use in fruit and vegetable production shown in Figures 1 and 2.

The labeling of these "fungicides" to control bacterial diseases raises a number of questions that remain unanswered. First, are these materials effective in controlling bacteria? Plant pathologists recommend their use only in an integrated pest management (IPM) system that also includes disease-resistant varieties, pathogen-free seeds and transplants, crop rotation, field sanitation, and spacing. Or, are chemical manufacturers simply adding additional pests to products used to control fungal diseases? If the materials are effective antibiotics, does their agricultural use adversely affect their ability—or the use of related chemicals—to control human pathogens? Since at least three of these materials (Agri-Phene, Decon Phase, and Mar-V-Cide II Germicidal Cleaner) are labeled for control of HIV and tuberculosis, it can be assumed that the potential exists to promote resistance in human disease organisms.

Health Impacts of Antibiotics Used in Agriculture

The main health impacts of antibiotic residues in food are the promotion of antibiotic resistance and disruption of the microbiota in the human gut.

Antibiotic resistance turns common infections deadly

The spread of antibiotic resistance is a health care crisis of major proportions. The Centers for Disease Control and Prevention (CDC) calls it "one of the world's most pressing public health problems." Many bacterial infections are becoming resistant to the most commonly prescribed antibiotics, resulting in 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.

The principal traditional antibiotics used in plant agriculture to fight disease are both important for fighting human disease. Tetracycline is used for many common infections of the respiratory tract, sinuses, middle ear, and urinary tract, as well as for anthrax, plague, cholera, and Legionnaire's disease, though it is used less frequently because of resistance. Streptomycin is used for tuberculosis, tularemia, plague, bacterial endocarditis, brucellosis, and other diseases, but its usefulness is limited by widespread resistance (U.S. National Library of Medicine, 2006).

It may not be widely appreciated that use of antibiotics on fruit trees can contribute to resistance to the antibiotic in human pathogens. The human pathogenic organisms themselves do not need to be sprayed by the antibiotic because movement of genes in bacteria is not solely "vertical," that is from parent to progeny—but can be "horizontal"—from one bacterial species to another. So, a pool of resistant soil bacteria or commensal gut bacteria can provide the genetic material for resistance in human pathogens.

The basic mechanism is as follows. If bacteria on the plants and in the soil are sprayed with an antibiotic, those with genes for resistance to the chemical increase compared to those susceptible to the antibiotic. Resistance genes exist for both streptomycin and tetracycline, and spraying with these chemicals increases the frequency of resistant genotypes by killing those susceptible to the antibiotic and leaving the others. Those genes may be taken up by other bacteria through a number of mechanisms, collectively known as "horizontal gene transfer."

The contribution of antibiotic use in fruit trees to resistance in human pathogens may not be nearly as important as the use of non-therapeutic antibiotics in livestock and farmed fish, but it does have an impact on the pool of antibiotic-resistant bacteria. Furthermore, residues of antibiotics in the soil may be taken up by treated or untreated plants and affect bacteria (Kumar et al., 2005).

Disruption of human gut microbiota

A human being contains more cells in and on the body that belong to microbes—and contain more microbial DNA—than those that originate from human genes. In fact, only 10% of human cells are genetically human, and only 1% of the DNA in the human is "human." The 90% of human cells that are microbial in origin are not (mostly) pathogenic, nor are they (mostly) just along for the ride. They are (mostly) symbionts that help the body function as it should. The human body, rather than being a distinct organism, should be thought of as a biological community, or "superorganism," truly the product of coevolution.

The main health impacts of antibiotic residues in food are the promotion of antibiotic resistance and disruption of the microbiota in the human gut.

In addition to interfering with digestion, exposure to antibiotics can disturb the microbiota, contributing to a whole 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, inflammatory bowel disease, and more. The human immune system is largely composed of microbiota. Not all disturbance in the microbiota comes from the conscious use of antibiotics. Researchers have recently documented that the rise in these same diseases is tightly correlated with the use of the herbicide glyphosate (Swanson et al., 2014). They have also shown that glyphosate exposure can result in the inflammation that is at the root of these diseases. The glyphosate results should not be surprising since the pesticide has been patented as an antibiotic, as discussed below.

Incubators of Antibiotic-Resistant Bacteria

The gut of humans and other animals provides an efficient incubator for antibiotic resistance. Antibiotic resistance increases first in commensal bacteria—the bacteria that naturally live within the human body—and may then be transferred to pathogens. Thus, the position that human pathogens are not present in orchards sprayed with antibiotics is irrelevant to the actual development and spread of bacteria resistant to antibiotics. The number of bacteria in the gut is large—often more than 10 bacteria of several hundred

species—with a large gene pool offering many mechanisms of resistance. Every exposure to antibiotics provides new opportunities for selection for resistance (Chee-Sanford et al., 2009).

Antibiotics from use on animals and crops are washed into waterways, where they find another environment perfect for encouraging the growth of antibiotic-resistant bacteria. Aquatic environments are rich in bacteria, and many of those bacteria contain genes for antibiotic resistance (Baquero et al., 2008). Thus, waterways are another place where pathogens can obtain genes for resistance.

GMOs, Glyphosate, and Antibiotic Resistance

The most widely used antibiotic in agriculture is glyphosate. Although it is registered as an herbicide, glyphosate works by attacking the shikimate pathway, part of the mechanism for producing certain amino acids in both plants and microbes. In fact, Monsanto holds a patent for glyphosate as an antibiotic. The patent for glyphosate claims efficacy against the malaria plasmodium and other protozoan parasites. Other research supports this claim and identifies the shikimate pathway as a target for *Mycobacterium tuberculosis,* the cause of tuberculosis (Schönbrunn et al., 2001). Thus, two of the most troublesome human diseases may be susceptible

Antibiotic Use in Fish Farms/Aquaculture

There are over 4,000 aquaculture facilities in the U.S., dominated by catfish farms in the south. The risks posed by antibiotic use are different in the varied systems of aquaculture: ponds, closed/recirculating systems, flow-through, net pens and sea cages. In net pens and sea cages, the release is directly into the ocean, where the chemicals and resistant bacteria can spread more easily. Other facilities may release water into natural waterbodies without treatment to remove antibiotics.

Eighty to 90 percent of total farmed fish production occurs in Asia and is known for overcrowded, unhygienic conditions that act as stressors to the fish and lead to the increased use of prophylactic antibiotics (Marshall & Levy, 2011). Although the use of antibiotics for non-therapeutic purposes in aquaculture is prohibited by law in the U.S., a study assessing the presence of 47 antibiotics in U.S.-purchased salmon, catfish, shrimp, trout, and tilapia originating from 11 different countries found sub-regulatory levels of antibiotics, which can promote antibiotic resistance development (Done & Halden, 2015). Additionally, this study detected the presence of virginiamycin below the regulatory level in salmon marketed as "antibiotic-free.

Entire populations are commonly treated when only a small percentage are sick, but that use is not considered "prophylactic." Such treatment is designed to protect the healthy fish, since the infected fish generally do not consume the medicated feed. The result is use of sub-therapeutic doses that promotes resistance and rarely clears the infection.

Antibiotic use is one of several factors to consider in choosing fish to eat. Other concerns include the contaminants in the fish's environment, sustainability of the feed, types of parasiticides used, and fishing practices for wild-caught fish. Key issues to consider when purchasing fish to eat, include the following: Is it farmed or wild? How is it farmed? What synthetic materials are used in its production? Is it associated with any contaminants?

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to antibiotics using glyphosate's mode of action. The use of glyphosate can thus be a contributor to the spread of resistance to medically important antibiotics.

Broadcasting this antibiotic on grain crops—and spreading genes for resistance through genetically engineered crops dependent on glyphosate—is as problematic as the use of streptomycin and tetracycline on fruit trees.

Regulation of Antibiotics in Agriculture Fails to Adequately Address Risks

Regulation of the use of antibiotics in agriculture is divided between FDA and EPA, with some oversight by USDA. FDA regulates antibiotics used as animal drugs, EPA regulates those used as pesticides, and USDA is responsible for conducting residue testing on animal products and other food products with established residue tolerance levels.

An application for a new animal drug is approved if FDA "agrees with the sponsor's conclusion that the drug is safe and effective if it is used according to the proposed label." FDA states that one goal is to "minimize the number of antibiotic-resistant bacteria that enter the food supply in or on food products made from treated animals," but has not incorporated in its regulation the assessment and prevention of exposure through waterways and manure, a gaping hole in the animal drug approval process that is unprotective of human health.

In response to widespread criticism of the use of antibiotics in animal production, as of January 1, 2017, FDA's Veterinary Feed Directive will limit to therapeutic use only (with the oversight of a veterinarian) the use of antibiotics that are medically important to humans in feed and water. While this move by FDA is important, it is an incomplete solution to the problem of promotion of antibiotic resistance by animal agriculture. Since any use of antibiotics increases the probability of resistance, the following remain problematic:

- Resistance may develop with the continued use of antibiotics that are not currently medically important to humans. As resistance continues to develop, medical professionals are turning to older classes of antibiotics, which must also be preserved for use in human medicine.
- FDA will still allow the use of antibiotics for disease-prevention, thus providing a loophole for antibiotic use in the absence of disease.
- Of the antibiotics that will no longer be allowed to be administered through feed or water as animal growth promotors, 89 percent can still be given to healthy animals for alternative reasons (Food and Water Watch, 2015).

EPA's assessment of pesticide risks generally addresses risks associated with direct exposure of humans to the pesticide.

In order to address the problem of antibiotic resistance by tetracycline and streptomycin, EPA's Health Effects Division adopted a qualitative risk assessment process similar to that of FDA's evaluation of animal drugs. The resulting risk estimate provides a qualitative indication of the potential to human health of the proposed use of an antimicrobial pesticide and is ranked as high, medium, or low. For streptomycin, "The assessment concluded that the possibility of antibiotic resistance resulting in adverse human health consequences was of medium concern following occupational application and was of high concern following application by residential users." For tetracycline, the resistance assessment finds, "The overall risk of the development of antibiotic resistance to oxytetracycline in human health and the environment is medium."

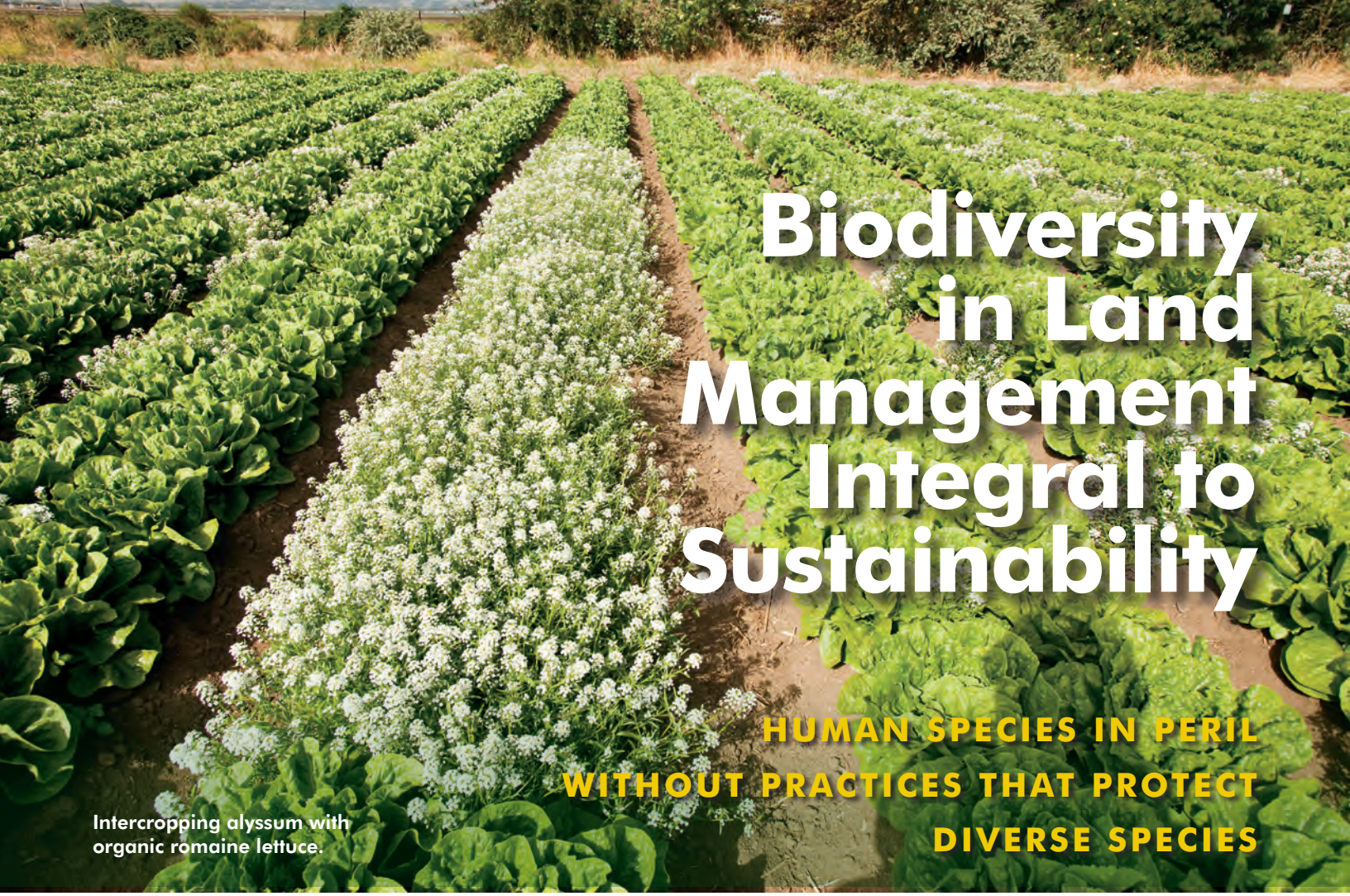
However, EPA's response to the "medium" level of concern is inconsistent with the FDA Guidance 152 on which it is based. If it were following the guidance, EPA would limit use to infected plants for a short period of time, classify antibiotics as restricted use, and monitor for resistance. These steps have not been taken.

The only reassessments of these two antibiotics that EPA has undertaken since 1993 have been tolerance reassessments. Since, as EPA states, if "bacterial resistance to oxytetracycline from pesticidal use occurs, it is most likely that it would be caused by development of resistance from non-pathogenic bacteria in orchards which later transferred their resistance to human bacterial pathogens," the reassessment of tolerances, which looks only at food residues, is inadequate for the assessment and management of the risk of antibiotic resistance. EPA's model for assessing and managing risk associated with pesticides thus proves to be inadequate to address the risk of antibiotic resistance.

Consumer Action Is Needed

Stringent regulations are needed to eliminate use of antibiotics in food production, which leads to antibiotic resistance, residues in manure, and contamination of waterways. The success of the NOSB in eliminating antibiotics in organic fruit production highlights successful alternatives to antibiotics. In order to move away from the dependence on antibiotics in human food production, research on alternatives and methods that have already proven efficacious must be expanded. For apple and pear production, switching to fire blight resistant varieties would reduce the need for intervention for fire-blight control. The push and pull of the marketplace, both by consumers and by producers, must work together to expand the number of food products raised or produced without antibiotics in organic systems.

A fully cited version of this article is available at bit.ly/pesticidesandyou.



Biodiversity in Land Management Integral to Sustainability

HUMAN SPECIES IN PERIL WITHOUT PRACTICES THAT PROTECT DIVERSE SPECIES

Intercropping alyssum with organic romaine lettuce.

TERRY SHISTAR, PH.D. AND CARLA CURLE

Human life depends on biodiversity—the diverse range of organisms that forms a community of interdependent species, collectively contributing to a healthy and sustainable environment. By some scientific estimates, published in *Science*, "Current rates of extinction are about 1,000 times the likely background rate of extinction. Future rates depend on many factors and are poised to increase." That is the challenge, and the solution is within reach.

Biodiversity above ground and below ground, from the smallest to largest life forms, are interrelated in ways not yet fully understood. Nevertheless, the escalating extinction crisis is measureable and marked by events such as the loss of passenger pigeons, whose flocks filled the skies for days on end and whose consumption of "mast"—nuts and acorns—effected the transfer of nutrients over long distances. Less visible has been the fragmentation of the mycelial mat that connected trees from the Atlantic Ocean to the Mississippi River and facilitated the sharing of a food source that allowed stronger trees to support weaker trees. A large part of the solution to the global threat to biodiversity is rooted in decisions that are made on land management practices in agriculture and communities.

In a community of species in which humans coexist and interrelate with a variety of organisms, community members interact in complex ways. Microbes in the gut of humans help digest food, and microbes in the soil help feed plants. Many of the species that were once a part of daily life for people are now gone or very rare. They are gone for many reasons, but mostly because their homes were turned into farms and cities. Many species that enriched the lives of human ancestors no longer exist. Beyond enrichment, without those species, the communities they supported are undermined. The loss of these communities is seen in the proliferation of "invasive species," climate change, epidemics of disease and resistant microbes. This puts human survival at risk. Human sustainability requires the nurturing and survival of a diverse community of species from the bottom up, starting with the soil.

Chemical-Intensive Agriculture Harms Biodiversity

Chemical-intensive, or "conventional," agriculture, as practiced today, poses a devastating threat to biodiversity. Approximately two-fifths of U.S. land is farmland—915 million acres or 40.5% of land in the U.S. (USDA NASS, 2014), while 37.7% of the land area worldwide is used for agriculture (World Bank, 2013). The land area devoted to chemical-intensive agriculture in the U.S. dwarfs the 5.4 million acres or 0.59% of land that is farmed with organic practices that seek to nurture soil

and ecosystem health while eliminating synthetic inputs incompatible with this goal. The other U.S. land uses, devoted to nonagricultural land purposes, includes 60.5 million acres or 2.6% of land in urban areas and 252 million acres (141 million of them in Alaska) of rural parks and wildlife space.

Farm practices are a critical contributor to the threat faced by a healthy and biodiverse ecology. Of the agricultural land in the U.S., 390 million acres (43%) are in cultivated crops, and more than half of that—220 million acres—is planted to three crops—field corn, soybeans, and wheat. Increasingly, these crops are grown in a monoculture (single crop, year after year) or short-term rotations (corn-soy-corn-soy, for example). In addition, pesticides are applied on:

- 100 million acres to kill insects (not including insecticide-coated or insecticide-engineered seeds),
- 286 million acres to kill weeds and brush,
- 14 million acres to kill nematodes,
- 35 million acres to control plant diseases, and
- 13 million acres to control growth, thin fruit, ripen crops, or defoliate crops (USDA NASS, 2012).

All of this pesticide use is designed to keep biodiversity at a minimum—to suppress the growth of species viewed as competition for the economic crop. In the case of species deemed beneficial to the crop, such as pollinators in numerous crops, the chemical-intensive farms require that the pollination services of beekeepers be brought in. The loss of biodiversity on farmland ultimately undermines the success of farmers around the world, as diverse ecosystems are more resilient to external stressors and more likely to prosper in spite of

Cover cropping in orchard.

© USDA

Pesticides Find Biodiversity as Their Target

Pesticides are labeled to control "target pests," but the idea that they kill only specific species has been proven false. In fact, product names themselves tell a different story, with examples such as Clean Field, Total Insect Killer, Prometon Total Kill, and The Spider and Insect Destroyer. Most insecticide labels display an extensive list of "target pests," along with a warning to avoid spraying when bees are in the field.

Numerous studies have found that pesticides have secondary effects not considered by the U.S. Environmental Protection Agency (EPA) or listed on the product label. In a 2016 study, researchers combined the results of approximately 1,000 observations for field studies across North America and Europe that had looked at the effect of neonicotinoid insecticide seed coatings on predatory insects. Predatory insects are reduced in study plots where coated seeds are planted, compared to the plots that are untreated by insecticides. In addition, the research findings conclude that coated seeds affect predatory insect populations similarly to soil and broadcast applications of pyrethroid insecticides.

Herbicides, such as glyphosate (Roundup), also function to eliminate a wide range of "weeds." The Roundup label demonstrates this, with the claim of "broad-spectrum control of many annual weeds, perennial weeds, woody brush and trees." These non-selective herbicides do not discriminate among plants, as they can kill or injure all plants that are present at the time of application, leading to an overall loss in biodiversity.

At the extreme are soil fumigants, applied to kill a wide range of organisms, including nematodes, fungi, bacteria, insects and weeds. The fumigant, Telone, used widely in agriculture to kill parasitic nematodes and control soil borne diseases, is fatal to humans if inhaled or swallowed and is toxic to mammals and birds. Widespread use of such products eliminates the soil diversity necessary to maintain ecological functioning.

So, despite a pesticide user's intention to kill only a particular "target" pest, pesticides generally kill much more indiscriminately. It is fair to say that the real target of pesticides is biodiversity itself.

Biodiversity as Defined by the National Organic Standards Board

Biological diversity (biodiversity) includes a variety of all forms of life, from bacteria and fungi to grasses, ferns, trees, insects and mammals. It encompasses the diversity found at all levels of organization, from genetic differences between individuals and populations (groups of related individuals) to the types of natural communities (groups of interacting species) found in a particular area. Biodiversity also includes the full range of natural processes upon which life depends, such as nutrient cycling, carbon and nitrogen fixation, predation, symbiosis, and natural succession.

Cover crops. © USDA

Conserving nesting sites. © Terry Shistar

them. By either knowingly or unknowingly contributing to biodiversity loss, farmers ultimately become more susceptible to pest pressures, disease, and drought.

Moreover, the landscape has become increasingly fragmented, containing pools of death merged into a sea of tiny islands with habitat. Conservation biologists now search for ways to create corridors linking such islands so that larger species will have enough habitat to survive. One review points out the unfortunate synergies among various threats: "Most forms of global change known to reduce population sizes and biodiversity will be exacerbated by fragmentation, including climate change, invasive species, hunting, pollution (including light, noise, and chemicals), and altered disturbance regimes."

Organic Agriculture Requires Biodiversity Protection

In making determinations on allowed materials in organic production, the National Organic Standards Board (NOSB), the stakeholder board created by Congress to oversee the implementation of the Organic Foods Production Act (OFPA), is required to consider "the effects of the substance [allowed in organic production] on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock." Moreover, organic regulations under the U.S. Department of Agriculture (USDA) define organic production as "a production system that is managed in accordance with the Act and regulations to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity." In promulgating the regulations, USDA said, "The use of 'conserve' establishes that the producer must initiate practices to support biodiversity and avoid, to the extent practicable, any activities that would diminish it. Compliance with the requirement to conserve biodiversity requires that a producer incorporate practices in his or her organic system plan that are beneficial to biodiversity on his or her operation."

Biodiversity brings benefits to the organic farm, but support of biodiversity on an organic farm also contributes to overall biodiversity in ways that go beyond the species living on the farm. Biodiversity in the soil food web of an organic farm leads to efficient cycling and retention of nutrients, control of soil-borne diseases and increased water-holding capacity and infiltration. Similarly, biodiversity above ground creates complex food webs, so that predators and parasites of crop-eating insects have shelter and alternative food sources. Predators, such as hawks, swallows, flycatchers, weasels, coyotes, frogs, snakes, and others, help to control rodents, insects, and other larger organisms that may pose problems on the farm.

In addition, organic farms that support diverse ecosystems contribute to larger scale biodiversity. Birds of prey and mammalian predators may not find sufficient food and shelter in a single piece of protected land. Adding habitat islands by way of organic farms can increase the land base that supports them. It also increases the diversity of landscapes, allowing greater numbers and types of plant and animal species to live in the area. This is especially important in a time characterized by "crop diversity loss and attendant homogenization of agricultural productions systems" in the U.S. (Aguilar et al., 2015). In promoting biological diversity in crops and landscapes, certified organic systems, as required by law, respect and harness biodiversity, while chemical-intensive systems do not.

Pollinator plantings. © USDA

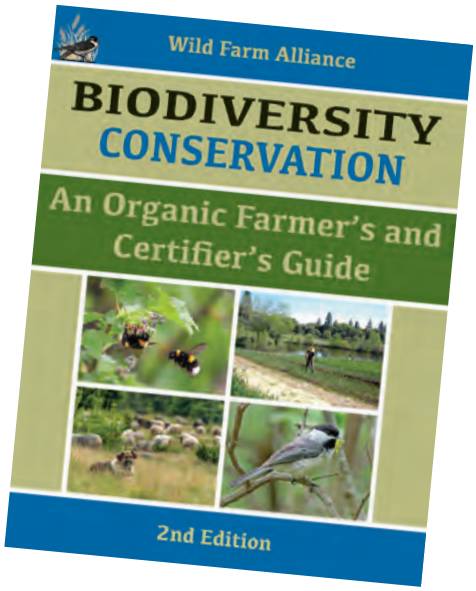
Despite legal requirements, and as the organic sector experiences a decade of sustained exponential growth, strict adherence to biodiversity conservation is an ongoing challenge. Assistance from the Natural Resources Conservation Service is available for many practices. The Wild Farm Alliance (WFA), a nonprofit organization that advances biodiversity on farms and the wider landscape, describes the spectrum of support for biodiversity:

> On one end of the spectrum, less sustainable, more intensified agriculture occurs with outside fertility and pest control inputs, monocultures, conversion of perennial habitat to crop fields, large field sizes, and fragmented or absent habitat. As the farm moves toward self-sufficiency and complexity, it supports soil biodiversity, protects soil and water quality, and provides flowering plants and native habitat patches with structural and compositional diversity that link together and connect to wilder areas on and off the farm. On this end of the spectrum, the farm is highly diversified and integrated into the larger landscape.

WFA has worked with the NOSB, USDA's National Organic Program, organic certifiers, and organic farmers to incorporate biodiversity conservation into organic systems plans. WFA recently updated its *Biodiversity Conservation: An Organic Farmer's and Certifier's Guide*, which explains biodiversity principles and outlines activities that organic producers can use to maintain and increase biodiversity in their operations, including crops, livestock, wild harvest, and handling operations. Numerous examples are given to help organic producers comply with the requirements of OFPA and help certifiers and inspectors assess compliance. Although not all organic producers are being held to these requirements, the guide illustrates the degree to which OFPA is a preeminent environmental statute that requires biodiversity conservation.

It is important that organic farmers understand how their operations affect on-farm and landscape biodiversity before prioritizing their management practices. The principles discussed in WFA's Guide build upon the foundations of promoting healthy soil and clean water by using cover crops, filter strips, and maintaining riparian zones along waterbodies. A companion WFA publication to the guide, the *Biodiversity Continuum Chart*, outlines practices ranging from "simple" to "complex." As a producer moves along the continuum and

From *Biodiversity Conservation: An Organic Farmer's and Certifier's Guide*, Wild Farm Alliance, 2016.



Hedgerows along hayfield.

Protecting wildlife corridors, especially along streams.

begins implementing these practices, the benefits of a complex ecological system are realized through increased yields, reduced pest pressures, and reduction of disease.

Organic farms can support a diverse food web by planting native plants and hedgerows, which act as a source of food for beneficial predators. In addition to these practices, organic farms are at the forefront in sequestering carbon or regeneration, thus mitigating the harmful effects from elevated carbon dioxide in the atmosphere. Organic practices utilize intercropping or cover crops between crop rows, delivering nitrogen to the soil and capturing atmospheric carbon through plant photosynthesis and depositing it into the soil. The soil becomes a sink for carbon, contributing to soil health by feeding soil microorganisms that cycle nutrients to support healthy plants.

Understanding the Economics of Biodiversity

The estimated economic costs of losses to biodiversity in the form of pollinator services, "beneficial" predators, birds, aquatic life and microorganisms are continually changing as more complex and comprehensive studies are published. Early studies estimate that the cost of losses to biodiversity might amount to more than $1.1 billion every year (Tegtmeier & Duffy, 2004). As techniques for assessing ecosystem services and valuation of organisms become more complex, studies find the loss of biodiversity resulting in costs in the hundreds of billions of dollars annually. Natural pest control is estimated to be worth $100 billion a year globally, and the role of soil biota in increasing agricultural productivity just from soil formation is worth $25 billion a year globally (European Academies Science Advisory Council, 2015). In the U.S., pollinators add more than $24 billion to the economy, with honey bees making up for over $15 billion of that amount.

Conclusion

Protecting and nurturing biodiversity is not a choice, it is a necessity to support life. Conventional agricultural strategies to "reduce" pesticides, such as undefined Integrated Pest Management (IPM) or generalized "sustainable" practices, typically look at narrow endpoints, measured by toxicity and exposure for discrete effects, rather than the full range of critical life-sustaining interrelationships of species. Nearly three decades ago, a clearly defined form of agricultural land management was defined by Congress in the Organic Foods Production Act, creating a clear framework for evaluating practices in the context of biological and chemical interactions in the agroecosystem through a public oversight process. This is a tool that offers broad opportunity to effect a transformation in both agricultural and wider landscape management in communities. The importance of this tool, with required plans, allowed biodiversity-compatible materials, certification, and oversight, put actual practices into a framework of review to support continuous improvement, while rejecting generations of chemical-intensive practices that have depleted environmental resources and disrupted complex biological processes. It is the integrity of the organic law and programs in place to implement it that will determine whether we embrace biodiversity and a future that sustains life or let the future slip away.

Jay Feldman contributed to this article. A fully cited version of this article is available at bit.ly/pesticidesandyou.

The Transformation of Chemical-Intensive Agriculture

PARTICIPATING IN THE TRANSITION TO ORGANIC, SUSTAINABLE, AND REGENERATIVE PRACTICES

As the National Organic Standards Board (NOSB) convened in St. Louis for its Fall four-day meeting on November 16, 2016, the continuing effort to transform chemical-intensive agriculture into a sustainable and regenerative system, still in its infancy, was on full display. Advocates view the transformation of agriculture to organic as essential in combatting major environmental issues of the day, including clean air, water, soil, worker protection, and carbon sequestration to slow global climate change. Two key issues before the board included the allowance of soil-less hydroponic production and the listing of carrageenan as an allowed food additive. Despite an earlier board decision rejecting soil-less hydroponic agriculture as organic, the board returned the issue to subcommittee with a resolution on distinguishing different production systems. The board also voted to prohibit carrageenan because of health concerns, environmental issues associated with the harvesting of its source material seaweed, and failure to find it essential to organic production. Other issues, as usual, tested the board's adherence to organic principles and the law.

Public Participation Critical to Organic Integrity

As a part of the meeting, the public gathered to participate in two days of public comment in what has been established as a democratic decision making process led by a Congressionally created 15-member board of stakeholders. The NOSB is, by law, charged with representing the different constituencies that make up the organic sector—farmers, environmentalists, consumers, processors, retailers, and certifiers. Additionally, a scientist is included on the board so that the process will be informed by independent science. Organic advocates recognize that the process is fraught with challenges that require a high level of public engagement to ensure adherence to principles and values integral to the Organic Foods Production Act (OFPA), which many people and organizations in the room participated in drafting originally and implementing since its passage in 1990 and rulemaking in 2000.

As envisioned under OFPA, those coming together brought a range of perspectives to debate the substances allowed in certified organic production. Foundational to this process are concerns among farmers, consumers, and environmentalists that growing the organic sector requires adherence to the governing principles and values of OFPA. Organic farmland (including cropland, pasture, and rangeland), despite its exponential growth in acreage—11 percent in the last two years—occupies 5.4 million acres, compared to the total 915 million acres of total U.S. farmland. It is a $43 billion industry built on a market that has high expectations for standards that are protective of the environment, biodiversity, and public health. Key to these expectations is a rigorous review process that rejects materials that have adverse health and environmental effects, are not compatible with organic systems, or are not essential—and subjects the materials to sunsetting and review every five years. This review was developed in contrast to the less rigorous standards applied to toxic materials used in chemical-intensive agriculture.

The Power to Chart the Future of Organic

The NOSB is uniquely empowered as the guardian of organic standards. In fact, OFPA contains a default assumption that synthetic materials are not allowed to be used without NOSB review and a recommendation adopted by a decisive two-thirds vote. Unlike most advisory boards under the Federal Advisory Committee Act (FACA), the Secretary of Agriculture is restricted in allowing discreet groups of synthetic substances only after the NOSB recommends a listing to the National List of Allowed and Prohibited Substances. Historically, the Secretary has not allowed nonsynthetic substances that are recommended for prohibition by the board. USDA is facing ongoing litigation for its failure to follow the procedures of the statute by promulgating changes without public input and recently lost a case in which it allowed pesticide contamination of green waste compost without consulting the public and NOSB (Center for Environmental Health, Center for Food Safety, and Beyond Pesticides v. USDA, U.S. District Court, 15-cv-01690-JSC, June 20, 2016). A similar case is pending on USDA-imposed changes that allow sunsetted materials to remain on the market.

Driving the process at the St. Louis meeting and on an ongoing basis is an organic systems approach to agricultural production that is not based on synthetic materials, but requires an organic plan that contains "provisions designed to foster soil fertility, primarily through the management of the organic content of the soil through proper tillage, crop rotation

Keeping Organic Strong

To track issues being deliberated by the NOSB and facilitate public comment to ensure organic integrity, Beyond Pesticides maintains the webpage *Keeping Organic Strong*. (See *bit.ly/KeepingOrganicStrong*.) The page provides a guide to the issues at each NOSB meeting. Check out the website about seven weeks before NOSB meetings in the Spring and Fall.

and manuring." (7 U.S.C. 6513 (b).) It is the role of the NOSB to ensure that the allowed materials are compatible with "biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms . . . crops and livestock." (7 U.S.C. 6518(m)(5).)

Hot Issues

The most hotly debated questions at the Fall meeting were whether carrageenan should be sunsetted as an allowed food additive in organic food, and whether hydroponic production should be eligible for certification as organic.

Carrageenan

Carrageenan, a thickener made from red seaweed, has been linked to a number of serious health impacts. The testimony and board discussion concerning carrageenan included health effects, essentiality, and the economic impacts of delisting carrageenan. Discussion of health impacts was largely concerned with whether one accepted industry science or independent science. Beyond Pesticides argued that the NOSB should take a precautionary approach in evaluating the science, given that the technical report was unable to give carrageenan a clean bill of health.

Organic food processors who have been following the carrageenan issue since it was last considered for sunset five years ago have mostly removed it from their products. Although some processors made the claim that it is essential, there is clear evidence that any organic product containing carrageenan is available in an organic form without it.

FMC, the manufacturer of carrageenan, brought in a stream of seaweed farmers from Indonesia and the Philippines to testify on the importance of carrageenan to their livelihood. Each of them was asked by the NOSB, "What proportion of the carrageenan produced goes into organic food?" When an answer was finally given, it was "a small amount," but FMC is concerned about the precedent of removing carrageenan.

The NOSB voted to remove carrageenan from the National List. However, questions still remain. The NOP's new sunset rules, which are being litigated, can be read as allowing the NOP to decide not to remove carrageenan. The law requires that USDA "may not include exemptions for the use of specific synthetic substances in the National List other than those exemptions contained in the Proposed National List or Proposed Amendments to the National List." This provision does not apply to carrageenan, which has been classified as nonsynthetic. However, OFPA also requires that the National List be "based upon" recommendations of the NOSB. In fact, in view of past actions of the NOP, it is not certain that NOP will actually remove carrageenan.

Hydroponics

The second major issue that was hotly debated at the meeting was the question of whether hydroponic growing systems are eligible for certification as organic. While the NOSB made it clear six years ago that hydroponics is not an acceptable organic production system, NOP has been allowing hydroponics to be certified contrary to the NOSB 2010 recommendation. Therefore, a group of soil-based farmers brought the issue to the NOSB. A task force was appointed to study the issue, and the Crops Subcommittee developed a proposal framed by NOP, to settle the issue.

The Hydroponics Task Force divided into two groups and produced separate reports presented under one cover. The task force addressed not only "hydroponics," but also variations known as "bioponics," "aquaponics," and "container-based culture." The Crops Subcommittee addressed all those variations. A discussion document on container systems was also prepared.

The major positions concerning hydroponics and its variants are: (1) it should not be allowed; (2) it should be allowed; and (3) it should not be allowed, but since NOP has been allowing it, it cannot be prohibited now. In addition, there were others who claimed that definitions needed to be clarified, and that perhaps aquaponics should be allowed, but not bioponics. In the end, the issue was sent back to the subcommittee, and the NOSB passed a resolution expressing opposition to the most extreme version of hydroponics—those operations that have a "water-based substrate."

The issue of hydroponics/bioponics/aquaponics and container growing is fundamental to organic production. It is connected with organic production as a system that works with nature, as opposed to conventional chemical-based production that works within an environment that is, to some extent, artificially controlled. Many of those opposed to hydroponics point out the precepts of organic production that are contrary to such systems: "Feed the soil, not the plant. "Return to the soil what you take from it." "Conserve biodiversity."

As an issue addressed by the NOSB, it is also important because it highlights NOP's willingness to defy the will of the board.

Other Issues

- The board passed a policy expanding on the definition of "excluded methods" terminology, which includes the definitions of genetic engineering, modern biotechnology, synthetic biology, non-GMO, and traditional breeding.
- Except for carrageenan, all materials up for sunset consideration stayed on the National List. These materials included copper sulfate, ozone gas, paracetic acid, List 3 inerts, calcium chloride, agar agar, animal enzymes, calcium sulfate, tartaric acid, cellulose, potassium hydroxide, silicone dioxide, and beta-carotene extract. No new materials were added to the National List. A motion to remove the parasiticide ivermectin passed.
- The board voted to send to the Secretary of Agriculture a report on the impact of USDA's allowance of genetically engineered crops on organic producers.
- The NOSB also approved a revised schedule for reviewing sunset materials and several revisions to the Policy and Procedures Manual.
- There has been no movement on the so-called "inert" ingredients in listed substances. To the extent that there are products allowed on the list that are not identified as active but in the product formulations, previous boards have determined that they need to be evaluated in accordance with the National List process. Those boards established a review process that has never been completed. This is a critical issue in the context of compliance with OFPA standards and is a good example of an issue that will require more public pressure to move to resolution.

The Future of Organic Integrity

The legal structure is in place for advancing organic in accordance with standards that establish farming and manufacturing practices that are compatible with the ecosystems in which they operate. The actual organic practices that have proved effective, productive, and economically viable are expanding at a fast rate. However, as the pace of organic acreage and the market grows, pressure to relax oversight, standards, and even the underlying law will increase. It will take a vigilant public to protect the basic values and principles that form the foundation of organic and have propelled it to this point to ensure its future. Organic requires a future that has integrity, public trust, and the exponential growth that is needed to protect the environment and people's health.

Please visit *Beyond Pesticides' Keeping Organic Strong* webpage, for more details.

— *Terry Shistar, Ph.D., Jay Feldman, and Carla Curle contributed to this piece.*

Peer Review Findings

A peer review panel conducted a review of the National Organic Program (NOP), the office within the U.S. Department of Agriculture that implements the Organic Foods Production Act (OFPA). In addition to assessing NOP compliance with procedures, the review evaluated the program's oversight of the agencies that certify farmers and processors who are authorized to display the organic label on their products. Many of the "opportunities for improvement" appear to be bureaucratic details. However, a closer look at the reports of the individual panel members identifies key issues:

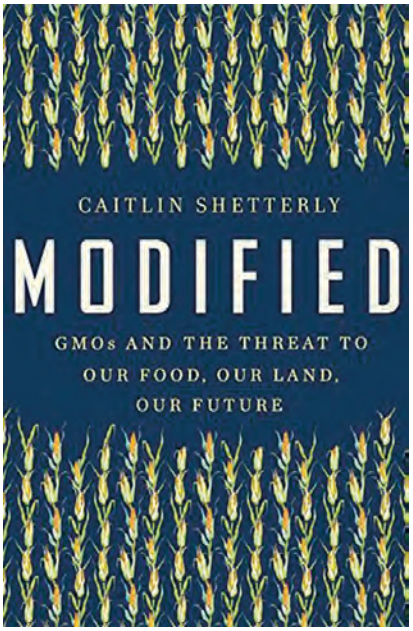
- Two reviewers identified problems with transparency—some documents were publicly available, while others were for internal NOP distributiion without justification. NOP policy states, "[P]rogram guidance documents are developed with adequate public participation, and are readily available to the public."
- NOP seems to lack clarity about the distinction between regulations, which are enforceable, and guidance, which is not. This is reflected in word use, such as "recommend," "require," "should," "shall," "must," and "may." It is also reflected in NOP's use of guidance as the basis for findings of non-compliance.
- The NOP organizational chart does not include the National Organic Standards Board (NOSB), which has specific statutory authority under OFPA.
- There was no evidence that NOP assessed compliance with NOP regulations requiring notification of "application, including drift, of a prohibited substance" or other changes that may affect compliance. In addition, requirements for certifiers do not mention submission of analyses and residue test results, as required by regulations.
- NOP auditors do not assess product composition or the method used to calculate the percentage of organic ingredients, which directly affect the label claim that can be used on a product making an "organic" label claim.
- NOP auditors have no guidance for assessing the regulatory status of ingredients and processing aids allowed by certifying agents, including guidance on the use of minor ingredients, processing aids and other non-agricultural substances, including nutrient vitamins and minerals in infant formula; verification that all ingredients and processing aids are used consistent with the National List annotation; and prohibition of optional materials rejected by the NOSB.
- Among the certifiers reviewed was Ecological Farming Control Organization (ETKO). ETKO was reviewed, in part, because NOP had been unsuccessful in suspending its certification. Based in Turkey, it has been criticized by Organic Farmers' Agency for Relationship Marketing, Inc. (OFARM). ETKO's certification has been suspended by the European Union and Canada. The peer review found that NOP's proposed suspension failed because, "In the letter of proposed suspension, the NOP did not provide sufficient details for the suspension, as required by 205.665(c1)."
- This review did not assess the NOP's compliance with regulations addressing the approval of foreign governments' accreditation programs and equivalency agreements.

by Jay Feldman

Modified

GMOS AND THE THREAT TO OUR FOOD, OUR LAND, OUR FUTURE

Caitlin Shetterly, New York: G.P. Putnam's Sons, 2015, 341pp.



This personal journey for the author, wife, and mother captures the escalating controversy over genetically engineered (also called genetically modified (GMO), or transgenic) food, the adverse impact on those who eat, grow, and study it, and the environment. The author, Caitlin Shetterly, set out to write a primer "for all those parents, out there who didn't understand (like I didn't) what the hell this GMO discussion was all about." She was actually drawn into this investigation, talking with doctors, researchers, farmers, and regulators, because of her own autoimmune disease.

Ms. Shetterly was diagnosed with eosinphlia, an immune system disorder that increases the body's production of eosinophils (white cells) in response to allergens, drugs, or parasites. The symptoms, "rash, arthritis, arthralgia, and other systemic symptoms," were diagnosed by her doctor, who had come to believe that the cause is GMO corn. According to the doctor, "[S]ome people might be developing a kind of chronic allergic response that was caused not by the corn itself, but instead by the proteins created by both the enterotoxins, bred into the corn to make it pest-resistant, and the proteins created from making it "Roundup Ready" (or impervious to the herbicide glyphosate marketed by Monsanto as Roundup)." Her symptoms subsided when she eliminated GMO corn from her diet.

In writing about the food system, the author describes a web of corporate influence, chemical and GMO contamination, intrigue, and intimidation of independent scientific researchers that have all the markings of a thriller. The growth of the GMO market, ineffective government oversight, secrecy of food ingredients, and broadscale contamination parallels the growth of the pesticide industry. Both claim to offer the promise of safe, highly productive, economical food production. The GMO story paints a picture of industry and government betrayal of their assurance to those who grow and consume food. It is explained in the author's journey and the farmers and researchers she speaks with along the way, intricately woven into industrial agriculture's chemical dependency on technology not fully studied for its effects on human health and the environment, involuntary genetic and chemical trespass on property and body, causing widespread contamination. As the author points out, you cannot see GMOs, just like you cannot see pesticides, in your food and the industry has spent tens of millions of dollars fighting state ballot initiatives and laws to make sure that consumers in the U.S. do not get clear information on GMO ingredients or pesticide use at the point of purchase.

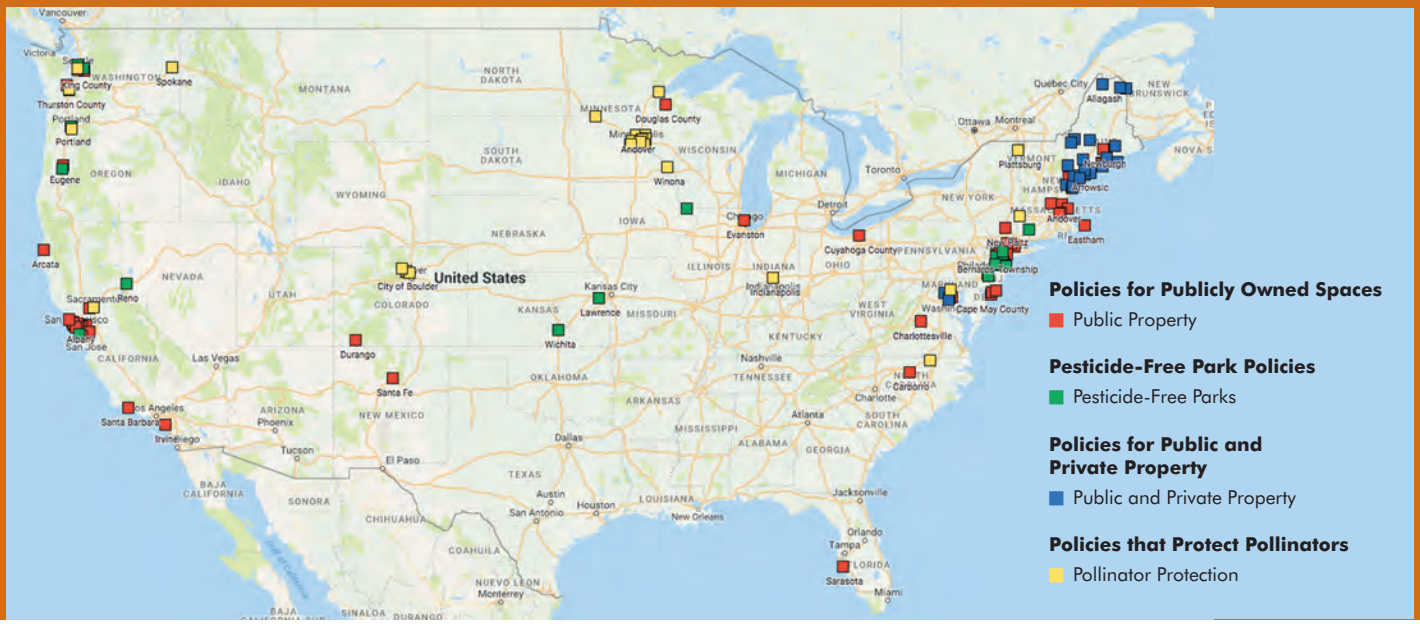
Last fall, *The New York Times* published an expose, *Doubts About the Promised Bounty of Genetically Modified Crops*, which affirmed what scientists, attacked by industry and government, had been writing about since the 1990's—"genetic modification in the United States and Canada has not accelerated increases in crop yields or led to an overall reduction in the use of chemical pesticides."

The author writes about the intrusion of GMOs and pesticides into the agricultural landscape as having devastating effects on biodiversity, including pollinators. She unravels the history of European labeling of GMO products, and the story of Oaxaca, Mexico's efforts to maintain the diversity and purity of its corn. You cannot finish reading this book without being troubled by corporate influence and deception associated with one of our most intimate acts, eating food, including efforts to ruin the reputation of respected scientists and pressuring a prestigious science journal to retract a pivotal peer reviewed article.

The author writes, "When you learn of the connection between Big Ag and Big Pharma you might wonder what Big Pharma has to gain from an allergy and autoimmune epidemic caused by pesticides and/or GMOs." An Iowa corn farmer, expounding on the virtues of GMOs during the author's road trip through the nation's heartland, discloses in the end that his brother's "dire health problems" and son's "allergy" are linked to GMOs. His family is now buying organic when they can.

MAP OF U.S. PESTICIDE REFORM POLICIES

These communities are protecting children and pets,and all residents from toxic pesticide use. Is yours? Check out what communities are doing across the country and join the campaign to move your community to toxic-free land management practices. Contact Beyond Pesticides at *bit.ly/SupportPesticideReform*.



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