Pesticides and You

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

Volume 36, Number 2

Summer 2016

Mosquito Control and Pollinator Health

Protecting pollinators in the age of Zika and other emerging mosquito diseases

Also in this issue:

- The Mosquito Doorknob Hanger
- Pest Management Practices Questionnaire
- Pollinators, Biodiversity, and **Scientific Integrity**
  –A talk by Jonathan Lundgren, Ph.D.

Despite Myths, Communities and Farms End Toxic Pesticide Use

Towns and cities across the country are going organic in the management of land within their jurisdictions because it eliminates use of chemicals that have known environmental and public health hazards. Community discussions are taking place in the spirit of biologist Rachel Carson, who with the publication of *Silent Spring* over 50 years ago alerted the nation to the adverse effects of DDT and other pesticides on people and wildlife. In this process, people are learning that toxic pesticides and synthetic fertilizers undermine the ability of nature through healthy soil biology teeming with beneficial organisms, including fungi and bacteria, to support thriving resilient lawns and landscapes. Beyond Pesticides engages the debate and provides technical resources to support the transition to soil management practices that prevent infestations, diseases, and weeds, and in the process protect pollinators, biodiversity, wildlife, and human health.

Since the 1960's, U.S. pesticide use to kill insects, weeds, and fungus has climbed to nearly a billion pounds annually. Per acreage use in parks, home lawns, and golf courses in some cases is higher than in agriculture, and a number of safety myths are often voiced by those who oppose banning lawn pesticides.

Myth 1: Our health is adequately protected by the Environmental Protection Agency (EPA) and the state pesticide regulatory agency. While states rely on EPA for the underlying assessment of pesticides' legal use patterns and allowable harm, epidemiologic and laboratory studies link pesticide use to disease outcomes, including cancer, neurological and immune system effects, reproductive disorders, Alzheimer's and Parkinson's disease, respiratory problems, and learning disabilities. The effects on vulnerable population groups, such as children and those with pre-existing health conditions, are elevated. The American Academy of Pediatrics in 2012 concluded, "Children encounter pesticides daily and have unique susceptibilities to their potential toxicity. . . Recognizing and reducing problematic exposures will require attention to current inadequacies in medical training, public health tracking, and regulatory action on pesticides."

Myth 2: The environment is adequately protected by EPA and the state. Ecological hazards of pesticides and their impact on complex biological systems in nature are even less studied than human health effects. With the severe decline of bees and other pollinators, EPA recently acknowledged that bees experience many indirect exposure pathways to a widely used bee-toxic insecticide, such as contaminated surface water, plant guttation fluids, soil, and leaves, and said it "lacks information to understand the relative importance of these other routes of exposure and/or to quantify risks from these other routes." This deficiency extends to the life-sustaining microbiome, or microbes, in the soil and in mammalian species, performing critical digestive, immune and biological functions.

Myth 3: **Toxicity classifications by EPA ass**ess the full range of acute and chronic effects. The toxicity classification of pesticide products does not tell the full story because it is limited to immediate poisoning effects and not long-term illnesses, such as cancer. Equally important, incomplete data are not a part of the classification. So, the public is not aware that the pesticides have not been tested for their ability to disrupt the endocrine system, the message center of the body, or the increased toxicity associated with mixtures of multiple pesticides on a treated lawn or playing field.

Myth 4: Pesticides used on private and public property stay where they are used. Pesticides move off the use site through drift and runoff. Those not allowed for indoor use find their way into houses, through air currents and being tracked inside. According to the U.S. Geological Survey, the overwhelming majority of the most popular pesticides have been detected in surface waters, including popular herbicides. In referring to various pollutants, including pesticides and fertilizers, for example, the Maine Department of Environment Protection states on its website, "Individually small amounts of pollutants may seem insignificant, but collectively they add up to create the largest source of pollution to Maine's waters." As a result, pesticide use on all property is a community public and environmental health concern.

Myth 5: We cannot have beautiful lawns without toxic pesticides. Toxic pesticides are not necessary for a landscape with beautiful turf, just as they are not needed in a $40 billion organic food industry. Organic turf systems focus on building soil health to support healthy lawns that do not threaten the health of children and pets that play on them. Numerous practices and organic compatible products work in concert with nature to enhance soil biology and the resiliency of grass and other plants, and cycle nutrients naturally. They also reduce energy and water use, sequester atmospheric carbon, and provide business opportunities for retailers and service providers. It's a win-win for health, the environment, and business.

Heal the soil to solve the bee problem and biodiversity crisis. Jonathan Lundgren, Ph.D., the renowned scientist who became a whistleblower when USDA stifled his research and publications, gave a chilling and, at the same time, uplifting talk at Beyond Pesticides 34th National Pesticide Forum this year. Excerpts of his talk are published in this issue and the complete talk is on our YouTube channel. Dr. Lundgren and the communities engaging to end the use of toxic pesticides know that the solution to ecological decline is within our grasp and, with Beyond Pesticides, are leading the way to transform our approach to land management.

Jay Feldman is executive director of Beyond Pesticides.

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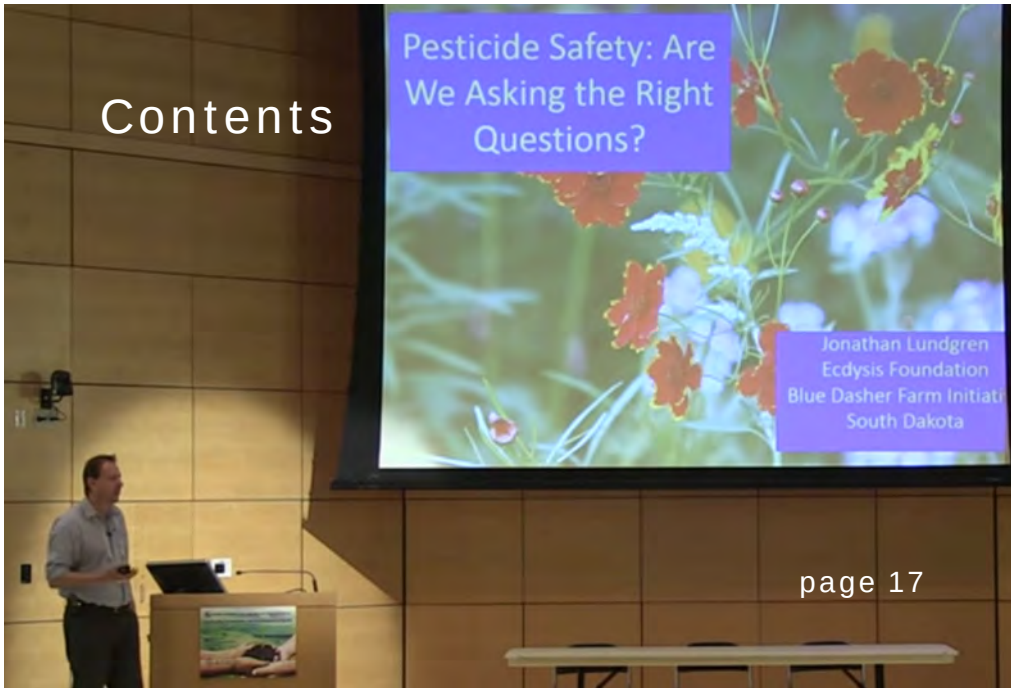

About the cover photo: this photo was a submission to Beyond Pesticides' 2014 pollinator photo contest, by Bev Veals, in Kure Beach, NC. It is titled, "Though they spray for mosquitoes, bees find a way to visit," reminding us that spraying pesticides for unwanted pests has a direct effect on non-target species.

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What Pesticides Are Sprayed on Cannabis?

Beyond Pesticides,

Thank you for your work on cannabis and pesticides. I really enjoyed your article in the winter 2014 edition of Pesticides and You, Pesticide Use in Marijuana Production: Safety Issues and Sustainable Options. I'm curious whether you know the top five or six pesticides that are currently being used on cannabis. Thanks again! – Sam Z., Washington State

Hi Sam,

Thanks for your kind words on our article. Although there continues to be controversy over legalization at the state and national level, Beyond Pesticides feels is it important to ensure that individuals using cannabis through state-licensed dispensaries, particularly medical users with chronic health conditions, are not poisoned by pesticide-contaminated products. Our report finds that pesticides not evaluated by EPA for health effects through inhalation, ingestion and skin absorption are being used in cannabis production. We've concluded that it is illegal to use registered pesticides that have not been evaluated for use in cannabis production. Since the release of our report, there has been a national conversation surrounding pesticide applications to cannabis, with mainstream news outlets picking up the story. Denver, Colorado has issued recalls on thousands of pesticide-tainted cannabis plants and products, and Colorado Governor Hickenlooper (D) declared contaminated cannabis "[a] threat to public safety" through executive order. California, a state that accounts for 50% of sales, issued its first guidelines on pesticide use in marijuana production, requiring safer practices than many other states. Oregon will require mandatory testing of nearly 60 different pesticide compounds of concern. However, problems remain, as state-sanctioned pesticide lists in Washington and other states continue to allow hazards, while certain growers [attempt to] skirt restrictions on highly toxic chemicals.

Cannabis recall lists in Colorado reveal that the same illegal pesticide use is continuing to show up. Chief among them is myclobutanil, the active ingredient in the fungicidal product Eagle 20, used to treat powdery mildew, a plant disease that poses little risk to consumers. Myclobutanil is classified as a reproductive toxicant under California's *Prop 65: Chemicals Known to the State to Cause Cancer or Reproductive Toxicity*. Insecticides used to control mite infestations, such as abamectin (another Prop 65 listed chemical), spiromesifen (associated in some studies with kidney/liver effects), and imidacloprid (a neonicotinoid linked to bee declines), are also frequently found on recalled plants.

On state-sanctioned lists, the synthetic pesticide synergist piperonyl butoxide (PBO) continues to be allowed for use. States cite its exemption from a tolerance (or acceptable residue) for food crops by EPA as the basis for allowing this and other federally registered pesticides on cannabis. Studies show it is frequently detected at high levels in cannabis products. Despite a 2006 EPA registration document indicating that the agency "will recommend . . . the revocation of the tolerance exemption…" for PBO, 10 years later it has yet to do so. Beyond Pesticides has sent several letters to the states of Oregon, Washington, and Colorado, urging that they not allow registered pesticides on cannabis, given insufficient data on health impacts. We have also put EPA on notice, as states continue to use the agency's insufficient guidance that permits the use of pesticides with general label language that are exempt from a food tolerance requirement. Beyond Pesticides is committed to encouraging safer practices within the fast-growing cannabis industry by promoting pest prevention through structural, cultural, and biological controls. When pest problems get out of hand, allowances for pesticides that are exempt from federal registration and allowed in organic production represent a route for effective pest management that also protects human health.

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.

Help Us Watchdog the Government: **Share Your Pesticide Incident**

Dear Beyond Pesticides,

A company hired by my neighbor to control mosquitoes inadvertently sprayed me in the face with two pesticide products containing synthetic pyrethroids. The company that made the application gave me the wrong MSDS for a product containing garlic oil and rosemary, so I'm not sure what to do and am experiencing neurological effects. I have reported this incident to the state pesticide regulatory department. An inspector was able to track down the correct names of the pesticides that I was sprayed with and is conducting an investigation. I wanted to make you aware of the incident and see if you had any further suggestions.

-Anonymous

Anonymous,

We're very sorry to hear about your incident and appreciate you sharing it with Beyond Pesticides. You made the right move by contacting the state pesticide regulatory department. Although EPA is responsible for registering pesticides, it delegates enforcement of pesticide law to the states. That being said, we do recommend you also contact your regional EPA officials and make them aware of the incident and ongoing investigation. Although state agencies are required to report pesticide poisonings to EPA, it does not always occur. We also strongly suggest that you fill out Beyond Pesticides' pesticide incident report form (located here: bit.ly/pesticidereport). The form will help you keep a written record of the event for future reference, as well as provide Beyond Pesticides with important evidence that we use to highlight the need for change. When filling out the form, please provide as much detail as possible, including, but not limited to, location, date, time, weather conditions (wind speed, temperature, etc.), the chemical or product used, and applicator license number. Please attach any relevant photos. The form provides an option for Beyond Pesticides to release this information to the media, policy makers, and other victims, and keep your personal information anonymous. In case there is further follow-up needed after this incident, Beyond Pesticides also maintains an internal reference list of lawyers and doctors, which we are happy to provide to you. Our organization monitors the effectiveness of state enforcement programs, so please keep us up-to-date on the status of your claim, and let us know if you encounter any difficulties in getting information. There are legal routes, such a state freedom of information laws, which can be used to find out the details of a pesticide investigation. Stories like yours underline the importance of prioritizing nontoxic alternatives to manage pest problems. We wish you the best in recovering from this incident.

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!

EPA Releases then Pulls Its Report that Disputes Cancer Finding for Glyphosate (Roundup)

Excerpt from Beyond Pesticides original blog post (5/6/2016): EPA Releases then Pulls Its Report that Disputes Cancer Finding for Glyphosate (Roundup). In May, the U.S. Environmental Protection Agency (EPA) published a long awaited review of glyphosate, the active ingredient in Monsanto's Roundup, concluding that the chemical is not likely to be carcinogenic to humans –then the agency removed the review from its website.

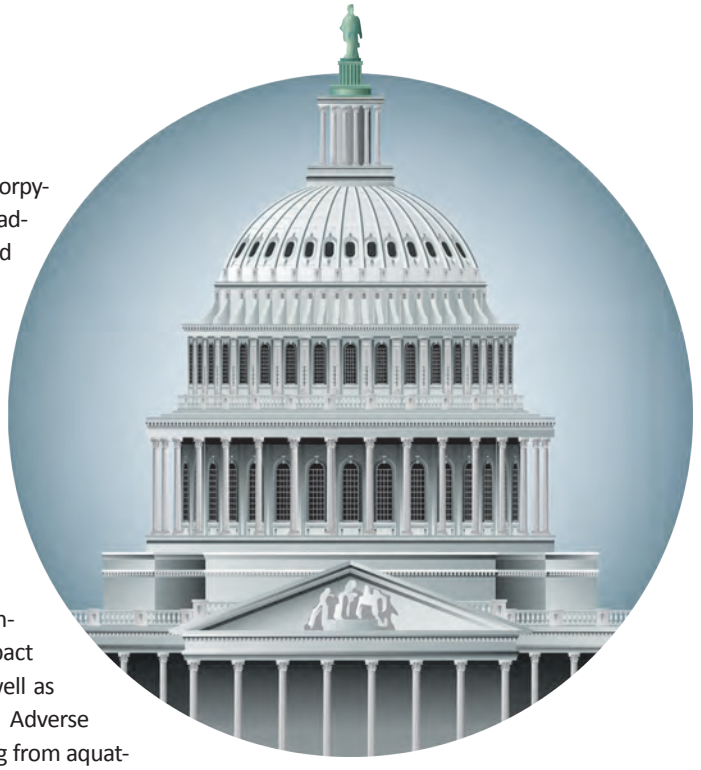
Christopher N. comments:

"Digging, weeding by hand, shovels, or hoes do not cause erosion. What causes erosion are the lightweight free particles that are constantly renewing in soils lacking carbon, humus, organic debris, mycelium, and other biological life. Trees, shrubs, saprophytic fungi, mycorrhiza fungi, humus, mulch, and manure all work synergistically to hold and catch healthy soils, while adding weight and structure. Weeding in these environments will not cause erosion to occur. Sandy, dusty dead soils are those most prone to erosion by water or wind. Examples of such soils would be Arizona, Nevada, or Northern Africa. The dust bowl was caused by over-farming the land without enough organic matter returned to the soils, which depleted nutrient content in the soil to the point that it could easily be picked up by the wind. Herbicides have no role in fighting erosion, but mushroom farms, compost and restoring forest cover sure do."

Javi G. comments:

"I find it incredible that, in the U.S., food is not already being tested to see if glyphosate in present in it. To me, it is just common sense. It definitely shows how powerful chemical companies are."

EPA Finds 97% of Endangered Species Threatened by Common Pesticides



Two commonly used pesticides are "likely to adversely affect" 97% of species listed under the *Endangered Species Act* (ESA), according to a first of its kind national assessment by the Environmental Protection Agency (EPA). The determination is part of a settlement reached by EPA and the Center for Biological Diversity, which requires the agency to complete a review of the impact of organophosphate pesticides chlorpyrifos, malathion, and diazinon by December 2017, and two carbamate pesticides, methomyl and carbaryl, by the end of 2018.

Under ESA, EPA is required to consult with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) when registering a pesticide in order to mitigate risks to endangered species. However, EPA routinely disregards this requirement, and has been sued numerous times for failing to ensure adequate protections for endangered species.

The review shows that pesticide impacts are ubiquitous, with EPA finding chlorpyrifos and malathion "likely to adversely affect" 97% of listed and candidate species and diazinon "likely to adversely affect" 79% of endangered species.

While all three chemicals are currently allowed for use in agriculture, the impact of chlorpyrifos and malathion is broader due to their allowance as a mosquito insecticide. EPA's analysis requires consideration of both direct impact through dietary exposure as well as indirect impact through prey. Adverse effects are far reaching, ranging from aquatic mammals like sea lions, to cave-dwelling spiders, and numerous listed birds.

This ESA assessment shows that these chemicals are not only toxic to humans, but put nearly every sensitive species in the U.S. in unacceptable danger. However, EPA's process for registering pesticides continues to institute restrictions intended to mitigate risks, and does not function to protect the most vulnerable in biological systems. This current review supports calls from health and environmental groups to eliminate the use of old, toxic organophosphate pesticides.

GAO Finds USDA Regulation of GE Crops Deficient

A study released by the U.S. Government Accountability Office (GAO) in late April assessed the actions of three government agencies responsible for regulating genetically engineered (GE) crops, finding several shortcomings in the process. The report finds that while EPA, the Food and Drug Administration (FDA), and U.S. Department of Agriculture (USDA) have taken some steps to regulate GE crops, USDA's failure to update its regulations that oversee GE crops has created a large data gap on the extent and impact of the unintended mixing of GE and non-GE crops. To address this, GAO recommended, among other things, that USDA set a timeline for updating its regulations and include farmers' growing identity-preserved crops in its survey efforts to better understand the impacts of unintended mixing.

GE crops pose a constant threat to the livelihood of organic farmers and undermine the burgeoning growth of the organic industry. A 2014 study released by Food and Water Watch and the Organic Farmers' Agency for Relationship and Marketing (OFARM), in response to USDA's Advisory Committee on Biotechnology and 21st Century Agriculture (AC21) report in 2012, found that one-third of organic farmers have experienced GE contamination on their farm due to the nearby use of GE crops. Over half of these growers have had loads of grain rejected because of unwitting GE contamination. These rejections can lead to big income losses for farmers, with a median cost of approximately $4,500 per year per farmer, according to the survey. Additionally, several farmers report annual losses of over $20,000 due to the need to establish buffer zones, while limiting the threat of contamination from their neighbors by taking contiguous farmland out of production.

Shifting the responsibility of contamination away from small-scale and organic farmers to the GE patent holder and GE farmers –a polluter pays principle– is an important first step in leveling the playing field and achieving the desired level of coexistence between growing operations.

Recent EPA Issuances and Retractions

Atrazine

In late April, EPA released, and then retracted, a preliminary ecological risk assessment of the toxic herbicide atrazine. This is part of a reevaluation of the chemical, scheduled to be completed in late 2016. Under federal law, every pesticide registered in the U.S. is required to undergo a 15-year registration review, analyzing its human health and environmental impacts to determine allowed chemical uses for another 15-year period.

EPA's preliminary ecological risk assessment found that for current uses at prescribed label rates, atrazine may pose a chronic risk to fish, amphibians, and aquatic vertebrate animals. Where use is heavy, the agency indicates that chronic exposure through built-up concentrations in waterways is likely to adversely affect aquatic plant communities.

Levels of concern, an equation that EPA produces to measure risk, were exceeded for birds by 22 times (22x), fish by 62x, and mammals by 198x. Even reduced label rates are expected to harm terrestrial plant species, as a result of runoff and drift from pesticide applications. It is important to note that these impacts are seen for uses which, based on data obtained during atrazine's last review 15 years ago, EPA considered to be "safe," when used according to label rates.

Moreover, as part of what are known as data call-ins, where EPA requests tests used to support or reject the registration of a pesticide, the agency permits pesticide manufacturers to carry out studies on their own products. Shortly before atrazine's most recent re-registration in 2003, University of California, Berkeley professor and scientist Tyrone Hayes, PhD was hired by Syngenta to conduct safety tests on the chemical for its impact on amphibian health. What he found was not what the company had hoped for. His experiments showed that atrazine impedes the sexual development of frogs.

In addition to reproductive impacts on amphibians, as well as studies showing similar impacts to fish, birds, reptiles, and mammals, the chemical has been associated with human health impacts, such as childhood cancer, and rare birth defects, including gastroschisis, and choanal atresia.

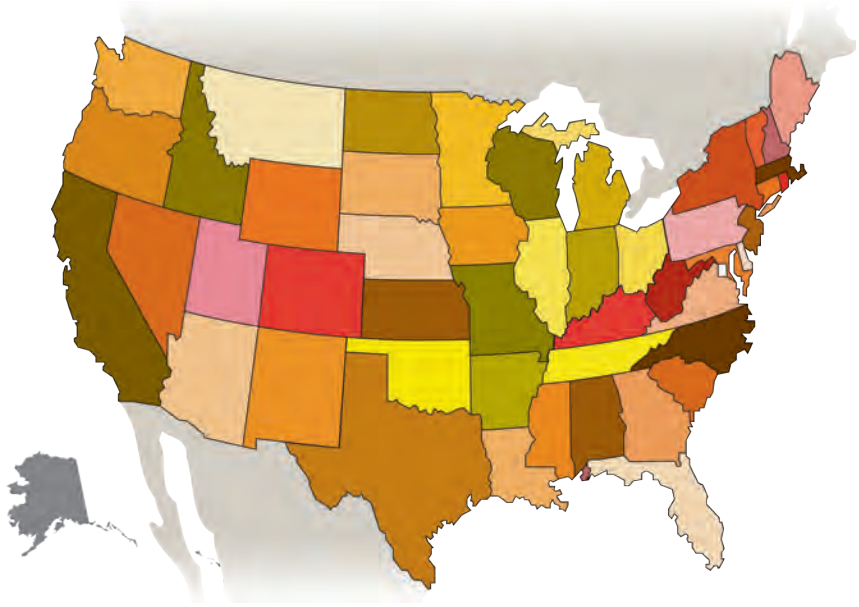
Southern Leopard Frog in the sun. Photo by Trish Hartmann.

Glyphosate

In early May, EPA published a long awaited review of glyphosate, the active ingredient in Monsanto's Roundup, concluding that the weed killer is not likely to be carcinogenic to humans –then the agency removed the review from its website. After pulling the report, the agency stated that the document was not final.

The 86-page report was published on regulations.gov by EPA's cancer assessment review committee (CARC) and was reviewed by *Reuters*. While the report found that glyphosate is not likely to be carcinogenic to humans, EPA told *Reuters* that it took the action it did because the assessment was not final. According to *Reuters*, "The agency said the documents were 'preliminary' and that they were published 'inadvertently.'" But, a cover memo, which was part of the assessment, described the report as CARC's final cancer assessment document. "Final" was printed on each page of the report, which was dated October 1, 2015. This only furthers speculation that EPA has concluded that it will renew glyphosate's registration.

Glyphosate has been subject to widespread public scrutiny since the World Health Organization's International Agency for Research on Cancer classified it as a 2A probable carcinogen, based on animal and epidemiologic studies. Due to drift and runoff, glyphosate residues have been detected in foods and products that are not typically associated with heavy glyphosate use, including organic foods and products, in which the use of glyphosate is prohibited. In March 2016, Moms Across America released a report on glyphosate residues in California wines. The report finds that all of the 10 wines test positive for glyphosate. Other recent reports of the widespread presence of glyphosate residues find the chemical in breast milk, in German beers (as well as in nearly 100% of Germans tested), feminine hygiene products, and bread.



Three New Campuses Join BEE Protective Campaign

In early April, Villanova University, located outside Philadelphia, PA, became the second school in the nation (Vermont Law School being the first) to receive recognition from the BEE Protective Campaign, a joint project of Beyond Pesticides and Center for Food Safety, that seeks to protect bees and other pollinators from harmful pesticides. Villanova maintains more than 50 pollinator-friendly plants on campus, including aster, black-eyed Susans, milkweed and mint, and signaled its continued commitment to using neonicotinoid-free insecticides on campus, making them one of the leading higher education institutions committed to the protection of pollinator species from neonicotinoid insecticides. Beyond Pesticides advocates organic management.

Hot on the heels of Villanova, Antioch College, located in Yellow Springs, OH, became the third campus to go neonicotinoid-free in late April. "At Antioch College, we have an opportunity and an urgency to be change leaders in turning around pollinator decline, exposing misleading research and recognizing the importance of inter-species cooperation," said Beth Bridgeman, the faculty member who drove the effort to ban neonicotinoids from campus. Antioch students and staff maintain about five acres of farmland that provide produce, eggs, pastured lamb, and culinary and tea herbs for the campus dining hall. Antioch is also working with Beyond Pesticides to move the campus to organic land management.

Macalester College in St. Paul, MN also pledged to become a designated BEE Protective campus in early May. "Macalester's new resolution to help protect pollinators fits well with our Sustainability Plan and Sustainable Landscaping Master Plan. I'm glad that our college has this opportunity to play a role in the fight to keep bees and other important pollinators safe from harmful pesticides," said Suzanne Savanick Hansen, Macalester College's Sustainability Manager. Neonicotinoids are a class of insecticides known to have acute and chronic effects on bees and other pollinators. With one in every three bites of food dependent on bees for pollination, it is imperative to adopt policies that protect pollinators from bee-toxic pesticides.

Milwaukie, OR Passes Resolution to Protect Pollinators

In late April 2016, the City Council of Milwaukie, Oregon passed a resolution that halts the use of bee-toxic neonicotinoid insecticides on city government and public property, joining the growing number of local governments protecting pollinators. Neonicotinoids have been widely cited in the demise of both managed and wild bee and pollinator populations. The resolution specifically restricts city government agencies from purchasing plants and seeds that have been treated with neonicotinoids and other systemic insecticides, and urges public and private landscapers and homeowners to plant bee-friendly habitats. Clackamas County will join with the Mayor's office and City Council of Milwaukie to adopt an Integrated Pest Management Plan that mirrors the resolution.

The city will pursue creating more native pollinator habitat, such as installing more pollinator host and forage plants. These installations will be placed in appropriate locations, such as rights-of-way, storm water management ponds, areas that are currently turf grass, vacant land, and at City facilities. They will also require that commercial pest service providers performing services for the City provide landscape services that encourage pollinator populations and support pollinator services.

"Support for this resolution has been phenomenal," said Mayor Gamba, who began working on the resolution less than a year ago. "It is incredibly important to protect our pollinators in every way possible." Because state preemption laws in 43 states prevent localities from enacting pesticide legislation stronger than state regulations, local resolutions that ban the use of neonics on public property are the strongest policies that preempted localities, like those in Oregon, can pass to protect pollinators. Other localities preempted by state legislation have enacted similar resolutions to protect bees and other pollinators on public lands, such as the cities of Boulder and Lafayette in Colorado.

Two States Move to Restrict Bee-Toxic Pesticides

Maryland

In a historic move, the Maryland legislature, in early April, became the first state in the nation to pass legislation banning consumers from using products containing neonicotinoid pesticides. The *Pollinator Protection Act* was approved by lawmakers by a 98-39 vote in the Maryland House of Delegates, and by a 34-12 vote in the Senate. Governor Larry Hogan (R) allowed the bill to become law without his signature.

While consumers will not be allowed to buy pesticide products containing neonicotinoids starting in 2018, the legislation's reach does not extend to farmers, veterinarians, and certified pesticide applicators, who will still be permitted to apply the chemicals. Consumers can also buy treated plants and seedlings from stores without any labeling. Cumulatively, these present major sources of exposure for bees and other pollinators.

As the bill made its way through the legislature, an amendment was attached to the Senate language, and later rejected, that implied legislative intent to preempt (take away) the authority of municipalities in Maryland that seek adoption of pesticide restrictions that are more restrictive than state policy on private property within their jurisdiction. The Senate language, which required a report and recommendations "to ensure state laws and regulations are consistent" with EPA, would have put the legislature on record, for the first time, as seeking to ensure preemption. Maryland is one of seven states that does not preempt local jurisdictions from adopting pesticide restrictions more stringent than state law.

Last year, Montgomery County, Maryland, with over one million residents, adopted a landmark ordinance that phases out the use of toxic lawn pesticides, including all neonicotinoids, for turf management on private and public land. This followed the adoption of a similar ordinance in Takoma Park, Maryland.

Connecticut

In late April, following a unanimous vote (36-0) of the Connecticut State Senate, the Connecticut House of Representatives also unanimously (147-0) passed Bill No. 231, *An Act Concerning Pollinator Health*, which is aimed at protecting declining pollinator populations within the state from toxic neonicotinoid pesticides. With Governor Dannel P. Malloy's (D) signature, Connecticut became the first state to sign into law statewide neonicotinoid restrictions on May 6, 2016. In summary, the bill does the following:

- Prohibits applying neonicotinoid insecticide (a) to linden or basswood trees or (b) labeled for treating plants, to any plants when such plant bears blossoms;
- Requires the Department of Energy and Environmental Protection (DEEP) Commissioner to classify certain neonicotinoids as "restricted use" pesticides;
- Requires the Connecticut Department of Agriculture (CDA) commissioner to develop best practices for minimizing the release of neonicotinoid insecticide dust from treated seeds;
- Requires the Connecticut Agricultural Experiment Station (CAES) to develop a citizen's guide to model pollinator habitat;
- Establishes a Pollinator Advisory Committee to inform legislators on pollinator issues;
- Specifies that Connecticut Siting Council orders to restore or revegetate in certain rights-of-way must include provisions for model pollinator habitat; requires the Department of Transportation commissioner to plant vegetation with pollinator habitat, including flowering vegetation, in deforested areas along state highway rights-of-way;
- Includes model pollinator habitat in any conservation plan CDA requires as part of its farm preservation programs;
- Requires the Office of Policy and Management (OPM) to amend the state's Plan of Conservation and Development to prioritize development with model pollinator habitat;
- Requires reports on (a) legislation needed to restrict or license planting neonicotinoid-treated seeds, (b) conditions leading to an increase in varroa mites, and (c) areas where the Department of Transportation (DOT) can replace turf grass with native plants and model pollinator habitat.

State and Local Action

These state bills include actions that are important steps to reversing the decline of both native and domesticated pollinator populations. However, in order to effect a change in fortune for these important animals, more states and localities must act to restrict the wide range of pesticides shown to harm pollinators. In the face of weak federal and state laws, even in states that preempt, or prohibit, local authority to restrict toxic chemical use on private property, you can work with your local government to adopt an ordinance that stops toxic pesticide use on all public property, land and buildings, and requires organic practices.

Washington State's Emergency Rule Allows Recall of Contaminated Cannabis Products

In late March 2016, Washington State's Liquor and Cannabis Board (WSLCB) adopted emergency rules allowing the state to recall cannabis products that have been tainted with illegal pesticide residues. The move follows widespread cannabis recalls in the City of Denver, and actions from Colorado's Governor to declare pesticide-tainted cannabis "a threat to public safety." Earlier in the month, Beyond Pesticides sent letters to Washington State Department of Agriculture (WSDA) and Governor Jay Inslee (D) imploring the state to take a proactive approach in restricting the use of hazardous pesticides in cannabis production.

Previously, Washington State had no process in place to remove illegally contaminated cannabis products from the market. WSLCB will now issue recalls or allow producers to initiate product removal if there is evidence that pesticides not approved by the state were used or are present on salable marijuana plants or products. However, because the state does not mandate batch testing of cannabis plants or products, it is unclear how or whether the new rule will be enforced.

In an interview with the *Seattle Times*, WSLCB spokesman Brian Smith indicated that the state will not be taking a zero-tolerance approach. "If a product tests very high for an unapproved pesticide, that will certainly increase the odds of recall. In the end, we may have to defend any potential recall action so a level of reasonableness will factor," Mr. Smith said.

Available data on exposure from pesticide residue in cannabis smoke raises serious health concerns. Those who use cannabis for medicinal purposes may have underlying health conditions that can be complicated or worsened by pesticide exposure. Implementing an emergency measure to allow state recalls is a step forward, but requires a strong enforcement mechanism and way of ensuring that even the most sensitive medicinal cannabis users are protected. Beyond Pesticides is urging states to prohibit registered pesticides in cannabis production, given the lack of testing for increased exposure through inhalation, ingestion, and skin absorption.

Minnesota Beekeepers Compensated for Bee Kills from Pesticide Drift

In the first test of a landmark beekeeper compensation law that works to protect beekeepers from the effects of toxic pesticides on their hives, Minnesota compensated two beekeepers for pesticide drift that killed their bees in late March 2016. Investigators from the Minnesota Department of Agriculture (MDA) have confirmed what beekeepers and environmentalists have been saying: Even when pesticides are used in accordance with the label and the law, they can be acutely toxic to bees in everyday circumstances.

Pam Arnold, an organic farmer who manages hives on her property, and Kristy Allen, another beekeeper who shares the same bee yard, were the first two beekeepers to actually receive compensation through the beekeeper compensation law. Last spring, a farmer across their road planted neonicotinoid coated corn seeds on a windy day, resulting in the death of their bees, as toxic dust from planting drifted onto their property. Tests performed by MDA during the investigation found acute levels of clothianidin in the dead bees, even days after the incident. Nearby dandelion weeds also showed significantly higher concentrations of the toxicant.

When farmers plant pesticide-coated seeds using a mechanical seeder, lubricants used to keep the seeds from sticking to the planter mechanism become contaminated and are expelled from the equipment as fugitive dust. The dust contaminates nearby plants. A 2012 study found that high amounts of neonicotinoids are present in the exhaust of corn seed planters and that bees are exposed to these potentially lethal concentrations of the chemical simply by flying through or near the area during planting.

Since 2014, MDA has investigated 10 complaints from beekeepers, but these were the first to be compensated for their losses under the law, according to a representative of the MDA Pesticide and Fertilizer Management Division. This demonstrates how difficult it can be to prove that pesticide drift has contributed to bee deaths, harm, or contamination.

"Though they spray for mosquitoes, bees find a way to visit."
Photo by Bev Veals, Kure Beach NC.

Mosquito Control and Pollinator Health

Protecting pollinators in the age of Zika and other emerging mosquito diseases

by Nichelle Harriott

In 2015, a beekeeper in Palo Alto, California, Randolph Tsien, made local headlines after he reported the loss of hundreds of honey bees from his backyard hives following the local fogging for mosquitoes carrying West Nile virus. In addition to losing his honey bees, Mr. Tsien was concerned about the contamination of his honey, which he once labeled 'organic.' Like Mr. Tsien, every year beekeepers and concerned citizens worry about the impact of mosquito control programs on honey bees and other pollinators. During the summer, mosquitoes become more active and the potential public health risks associated with them begin to make national headlines.

While mosquito-borne transmission of Zika virus has not been reported in the U.S., the virus has been found in travelers to the U.S. from countries where infected mosquitoes have been reported. (Centers for Disease Control (CDC), 2016) In 2015, 48 states and the District of Columbia reported West Nile virus infections in people, birds, or mosquitoes, with most people reporting no symptoms; 2,060 cases were reported to the CDC. Dengue is rarely reported in the continental U.S. and no mosquito-borne cases of chikungunya have been reported in the U.S. As mosquito abatement districts across the country gear up during the summer, it is prudent to keep in mind that while mosquito management is a necessary public health service, common methods of control –aerial and ground spraying of pesticides– not only have questionable efficacy, but can also harm non-target organisms like pollinators, whose populations are already suffering elevated losses.

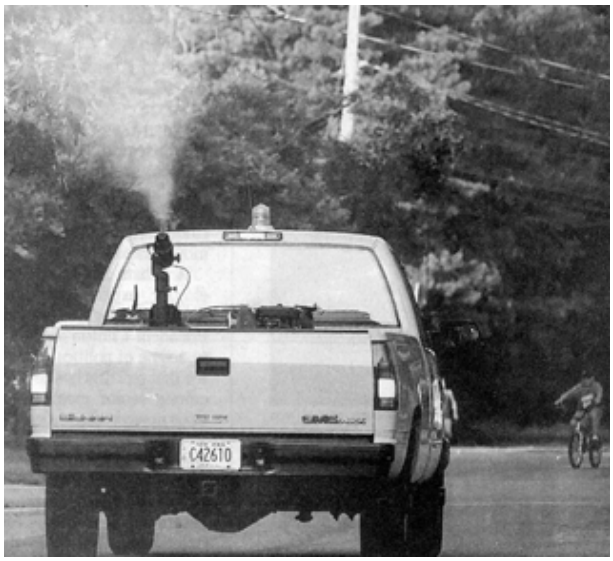
In this piece, we explore how commonly used mosquito control pesticides and their application can potentially harm bees, butterflies, and other beneficial insects, ultimately affecting overall biodiversity. While we do not underestimate the threat from new and current mosquito-borne diseases, an ideal mosquito management strategy adopts an integrated approach that emphasizes education, aggressive removal of breeding sites (such as standing water), larval control, monitoring, and surveillance. Alternative strategies, including introducing mosquito-eating fish, encouraging predators, such as bats, birds, dragonflies, and frogs, and using least-toxic larvicides, like *Bacillus thuringiensis* (Bt), can be applied successfully without endangering pollinators and other organisms.

A note about wild native bees: While this article cites data regarding honey bees, wild native bees are equally, or even more, at risk from mosquito pesticides. Studies note that certain wild bee species are more susceptible to pesticide exposure than honey bees, due to differences in biology and habitat. One author observed that the trend in susceptibility to pesticides is directly correlated to the surface/volume ratios –which influence contact exposures of wild bee species, with the susceptibility sequence (lowest to highest) as follows: *alfalfa leaf cutting bee –> alkali bee –> honey bee –> bumble bees*.[1]

People can protect themselves from mosquitoes by using least-toxic repellents like oil of lemon eucalyptus, wearing light long-sleeve clothing when outdoors, and avoiding outdoors when mosquitoes are most active.

Widespread spraying: more risk than benefit

Pollinators are facing unprecedented declines and pesticides have been identified as one of the main contributing factors in their decline. A recent government survey put honey bee hive losses between April 2015 and April 2016 at 44 percent, the second highest on record.[2] Insecticides, like neonicotinoids, have been especially singled out as a major contributor because of their widespread use in agriculture –foliar sprays and seed coatings– and in home gardens, their elevated toxicity to honey bees, and prolonged exposure as a result of their persistence and systemic contamination of pollen and nectar, and other parts of the plant. Spray applications and the planting of seeds coated with these pesticides have resulted in large bee deaths in urban and agricultural landscapes across North America and Europe.[3] And while neonicotinoids have attracted the most scrutiny, other classes of pesticides are also highly toxic to bees. These include pyrethroid and organophosphate insecticides, which are widely used in public health mosquito control programs across the U.S.



Mosquito abatement programs can vary across states, but most involve widespread aerial and ground spraying of insecticides across urban and rural areas to control disease-carrying mosquitoes. Common insecticides used as part of these programs include permethrin, malathion, naled, phenothrin (sumithrin), pyrethrin, and resmethrin (which was withdrawn in 2015, but existing stocks may still be used).

The application of these pesticides puts bees, birds and other pollinators in harm's way. Impacts on these non-target organisms may be exacerbated by the increased use frequency of mosquito control insecticides within short time durations, which may occur during periods of high mosquito pressure.[4] When it comes to regulating mosquito pesticides used to control mosquito-borne diseases, oftentimes additional mitigation measures or use restrictions for these pesticides are typically waived for public health mosquito control uses, putting non-target organisms at risk, contaminating water bodies, and increasing hazards to humans.

"To fully protect honey bees and native pollinators from mosquito control pesticides, the pesticide should only be applied when it is dark, the sun has set and the street lights are lit. Dark is dark, not twilight, not sunset: dark."
–Pollinator Stewardship Council

"The mitigation measures proposed for when bees are present under contract pollination would not apply to applications made in support of public health, such as use for wide area mosquito control. EPA recognizes that a wide area mosquito control application can impact large numbers of bees if the application co-occurs in areas with pollinator-attractive plants; however, such applications utilizing products classified as acutely toxic to bees are used to protect public health through mosquito abatement."
–EPA 2015

Large-scale mosquito control applications are made with ultra-low volume (ULV) sprays that dispense very fine droplets of the pesticide product into the air, killing mosquitoes and other non-target insects that come into contact with the fine mist. Because ULV sprays target adult flying mosquitoes, they are only a temporary control measure. The sprayed pesticides do not affect mosquito larvae left behind to propagate another generation of adult mosquitoes, ensuring the need for subsequent spraying. According to one study, flying insect abundance decreases after ULV application of insecticides, while larval mosquitoes remain.[5] Additionally, because the ULV spray can only kill mosquitoes that the fine particles come into contact with, the number of which may be limited (one study notes that less than 0.0001% of the insecticide reaches the target mosquitoes),[6] this method is not an effective long-term strategy to effectively control mosquito populations. The efficacy of ULV spraying also depends on time of day applied, and weather factors, such as wind velocity and direction, temperature, and atmospheric stability and turbulence.[7] In addition, some species of mosquitoes, like the *Aedes* species (e.g. *Aedes aegypti*),[8] are more active during the daytime and some even prefer being indoors, all of which can impact the effectiveness of ULV spraying.

Typically, mosquito abatement programs spray at or near dusk, or twilight, when most adult mosquitoes are active. There is a common misconception that conducting ULV mosquito applications in the late afternoon is ideal, assuming bees are not active during this time. But according to the Pollinator Stewardship Council (PSC), a national beekeeping organization, this is false. PSC notes that honey bees and native pollinators will forage blooming plants until the sun sets, and can be active during dusk, right up till nightfall.[9] Additionally, warm nighttime temperatures and high humidity may induce bee aggregation at the hive entrances, even though they are not actively foraging.

What can kill mosquitoes *CAN* kill pollinators

The U.S. Environmental Protection Agency (EPA) has identified 76 pesticide chemicals that are highly acutely toxic to honey bees.[10] These were singled out because they have an acute contact toxicity value of less than 11 micrograms per bee (LD50<11 micrograms/bee) and can be applied in ways that can expose bees. Of these, several are used to control mosquitoes, including malathion, naled, permethrin and phenothrin, which are the most commonly used for ultra-low volume aerial and ground spraying (see *Table 1*, p13).

A. Organophosphates: Malathion, Naled, and others

The organophosphate malathion is widely used in many mosquito control districts across the country and has been used since the 1960s. It is an adulticide, meaning it targets only the adult stage of the mosquito, and not the juvenile/larval stage. Applied by both ground and aerial ULV spraying, malathion spray drift can travel and impact a wide area, exposing non-target organisms and humans alike. These applications have resulted in the death of many bees and impaired bee colonies due to daytime application of malathion.[11] Studies have reported that colonies exposed to ULV malathion weighed significantly less for up to 28 days when compared to control colonies, indicating colony decline.[12]

Malathion. Malathion is highly toxic to honey bees (LD50 of 0.71 micrograms/bee). Residues on plants and other surfaces indirectly expose bees to malathion, which is also systemically absorbed by plants, translocating throughout the plant and into pollen and nectar, further exposing foraging bees.[13] Bees carrying contaminated pollen back to the hive unwittingly expose the entire colony to malathion residues. Honey bees, pollen, wax and honey have all been found to be contaminated with malathion residues, according to Johnson et al. (2010).[14] Exposures to worker bees have been found to decrease their longevity.[15]

Aquatic organisms, including fish, invertebrates, and amphibians, are also severely affected by malathion, as the insecticide is highly toxic to these organisms. According to EPA's registration documents for malathion, there are several toxicity studies with aquatic insect larvae that show malathion is highly to very highly toxic to non-target insects with aquatic early life stages.[16] This, coupled with the fact that it is very soluble in water, has a half-life of approximately one week, and is more stable in acidic aquatic conditions,[17] makes malathion a threat to non-target species. As a result of malathion's toxicity to non-target organisms, precautionary statements are required on malathion product labels in an attempt to limit exposure to honey bees and other beneficial insects during applications of malathion.[18]

Naled. Like malathion, naled, commonly known by its trade name Dibrom, has been used for mosquito control for several decades. Elevated mortality rates among honey bees have been documented after nighttime aerial ULV applications of naled.[19] Additionally, average yield of honey per hive is significantly lower in exposed hives.[20] Naled is highly toxic to honey bees (LD50 0.48 micrograms/bee)[21] and some have observed that naled killed bees at 30 and 60 meters from the path of ground ULV applications.[22] Consequently, ground application and the subsequent deposition on surfaces show a positive correlation with bee mortality.[23] Adult bees are more sensitive to naled than younger bees,[24] though studies show a significant decrease in residual toxicity from 3 to 24 hours post-treatment.[25] EPA registration documents note that naled is moderately to very

As organophosphate insecticides, both malathion and naled can affect the human nervous system causing nausea, confusion and dizziness, as well as respiratory distress. Long-term neurological effects have also been documented.

Following the Label

Label directions are often difficult to follow and not adhered to in the real-world. Many beekeepers can attest to this and have repeatedly communicated this to EPA enforcement and registration officials. The images below are pieces taken from a 22 page booklet attached to the product Ortho® MAX® Malathion Insect Spray Concentrate (which is considered the product label). The environmental hazards section, which gives specific instructions for protecting bees, appear on the back cover and on page 10 (circled in red). It states: "Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area."

NUISANCE INSECTS - Outdoors Only		
TO KILL THESE INSECTS	Clover Mites, Ants (except Fire, Pharaoh, Carpenter and Harvester Ants), Crickets, Earwigs, Roaches, Spiders, and Adult Mosquitoes.	
IN THESE AREAS	Exterior House Foundation; Patios and Garbage Cans; under Porches and Shrubbery; Along Fences; Firewood Piles; and Ornamental Vegetation	
	INSECT	AMOUNT
USE THIS AMOUNT	Clover Mites	2 tsp per gallon of water. Ortho® Dial 'N Spray® setting is 2 tsp.
	Ants, Crickets, Earwigs, Roaches & Spiders	8 Tbs (4 fl oz) per gallon of water. Ortho® Dial 'N Spray® setting is 4 oz.
	Adult Mosquito Control	9 Tbs per gallon of water. (use tank sprayer only)
HOW TO APPLY	•Use an Ortho® Dial 'N Spray® or tank sprayer. •Apply as a coarse spray to the lower outside foundation of house, patios and garbage cans; under porches and shrubbery; along fences; to firewood piles; and ornamental vegetation where mosquitoes may rest. •Specific directions for Clover Mites: Spray a 2-ft wide strip along side of house. •DO NOT USE INSIDE THE HOME. DO NOT USE ON ANIMALS.	
WHEN TO	Apply as necessary to control listed insects; waiting at least	

ENVIRONMENTAL HAZARDS

This pesticide is toxic to aquatic organisms. Including fish and invertebrates. To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help ensure that wind or rain does not blow or wash pesticide off the treatment area. Rinsing application equipment over the treated area will help avoid run off to water bodies or drainage systems. Drift and run off may be hazardous to aquatic organisms in areas near the application site. This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.

PHYSICAL OR CHEMICAL HAZARDS: Combustible. Do not use or store near heat or open flame.

NOTICE: To the extent consistent with applicable law, buyer assumes all risks of use, storage, or handling of this product not in accordance with directions.

The ORTHO® Guarantee: If for any reason you, the consumer, are not satisfied with this product, mail us your original proof of purchase to obtain a full refund of your purchase price.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

Precautions and Restrictions:

DO NOT APPLY THIS PRODUCT IN A WAY THAT WILL CONTACT ANY PERSON OR PET, EITHER DIRECTLY OR THROUGH DRIFT. KEEP PEOPLE AND PETS OUT OF THE AREA DURING APPLICATION.

DO NOT ALLOW PEOPLE OR PETS TO ENTER TREATED AREA UNTIL SPRAYS HAVE DRIED.

Do not use food utensils such as teaspoons and tablespoons for food purposes after use with pesticides.

tsp = teaspoon Tbs = Tablespoon
3 teaspoons (tsp) = 1 Tablespoon (Tbs) = ½ fl oz

When using Ortho® Dial 'N Spray®
1. Set dial to the setting indicated in the use directions for your specific application.
2. Pour product into sprayer to fill jar one-quarter to one-half full.
3. After spraying, unused product must be poured back into its original container.

When using a tank sprayer
1. Blend appropriate amount of Ortho® MAX® Malathion Insect Spray Concentrate with appropriate amount of water following the dilution instructions for each site-pest combination listed below.
2. Operate sprayer by following the manufacturer's instructions. Spray as directed below.

highly toxic to freshwater fish on an acute basis, and very highly toxic to freshwater aquatic invertebrates.

Dichlorvos. Naled degrades into dichlorvos, which is also registered as a pesticide and used in mosquito control products. Dichlorvos is also highly toxic to bees (LD50 0.495 micrograms/bee) and EPA notes that exposure "may lead to mortality to this and other insect pollinators." Similarly, EPA states, "Listed plant species dependent upon insect pollination may be indirectly affected by the loss of all or part of such insect populations. Additionally, the potential risk to bird species from dichlorvos use could also affect bird-pollinated plant species."[26]

Applying a pesticide to mosquito breeding ground site in waterbody in Monmouth County, NJ. Photo courtesy NJTV News.

Chlorpyrifos. Chlorpyrifos, a controversial organophosphate known for its neurotoxicity and impacts on children's learning and development, is also highly toxic to honey bees (LD50 is 0.36 micgrogram/bee).[27] Honey bees experience a learning and memory deficit after ingesting small doses of the chemical, potentially threatening their success and survival, according to Urlacher et al. (2016).[28] Although most residential uses were cancelled in 2001, it can still be used for public health mosquito control, despite efforts to have the chemical completely banned, and is frequently been detected in honey bees. According to a study conducted in 2015 by the U.S. Geological Survey (USGS), 17% of bees tested positive for chlorpyrifos residues.[29]

B. Pyrethroids: Permethrin, Phenothrin, Resmethrin and others

When it comes to honey bees, synthetic pyrethroids, introduced in the 1960s, are generally highly toxic. In spite of this, mosquito control officials commonly say that pyrethroids pose minimal risk to bees due to their low application rates in the field and claimed repellent properties.[30] However, real-world and laboratory evidence dispute this. Pyrethroids are frequently associated with bee kills and colony collapse disorder (CCD)-like symptoms, characterized by bees' disappearance from their hives.[31] One study reports that after exposure to sublethal levels of permethrin (0.009 micrograms/bee), worker bees failed to return to the hive at the end of day, while only 43% of these bees were eventually able to return to the hive because of disorientation due to treatment.[32] Pyrethroids have also been found to significantly reduce bee fecundity, decrease the rate at which bees develop to adulthood, and increase their immature periods.[33] A 2015 study finds that exposure to pyrethroids reduces bee movement and social interaction.[34] This study also found that pyrethroid-exposed bees travel 30-71% less than unexposed bees, and those exposed to both the pyrethroids esfenvalerate and permethrin decreased social interaction time by 43% and 67%, respectively.

Salvato (2001), who examined the toxicity of naled, malathion, and permethrin to five species of butterflies, including larval and adult stages, found that naled and permethrin were the most toxic to all life stages.[35] Resmethrin adversely affects butterfly larvae and adults directly exposed to resmethrin ULV spray.[36] In a similar study by Hoang et al. (2011), which looked at the impact of mosquito control pesticides on non-target organisms, several butterfly species were found to be more sensitive to these insecticides than honey bees.[37]

High levels of pyrethroids have been detected in pollen collected by honey bees. One study by Penn State and USDA researchers finds that pyrethroids are quantitatively the most prevalent of pollen residues, with up to 10 different pyrethroid compounds per sample.[38] A recent study by Long and Krupke (2016) notes that

A note about insecticide resistance in mosquitoes:

The more insecticides are relied upon to control mosquito populations, the quicker mosquitoes develop resistance to the insecticides. According to Liu (2015), a large number of studies show that multiple, complex resistance mechanisms, like increased metabolic detoxification of insecticides, is likely responsible for mosquito resistance.[39] In general, genetic mutations result in mosquito resistance to pyrethroids, organophosphates, and carbamates.[40] The World Health Organization (WHO) has documented mosquito resistance to pyrethroid, organochlorine, organophosphate, and carbamate insecticide classes across the globe.[41] To combat mosquito resistance, the dependency on chemical control must be addressed and lead to more sustainable methods, which include habitat modification, improved sanitation, and use of natural controls.

Table 1: Pesticides Used for Mosquito Control

Pesticides Registered by EPA for Mosquitoes as a Target Pest[i]	Used in Vector Control Programs[ii]	Toxic to Honey Bees[iii]	Toxic to Other Non-Target Organisms
Larvicides: Biological Controls			
Bacillus thuringiensis israelensis			Not documented.
Bacillus thuringiensis sphaericus			Not documented.
Spinosad		✓	✓ Very highly toxic to oysters.
Larvicides: Synthetic			
Diflubenzuron			✓ Very highly toxic to freshwater aquatic invertebrates.
Growth Inhibitors			
Methoprene		✓[iv]	✓ Toxic to some fish, highly toxic to freshwater invertebrates and amphibians.
Pyriproxyfen			✓ Toxic to aquatic invertebrates and crustaceans.
Adulticides			
Acetamiprid		✓	Not documented.
Bifenthrin		✓	✓ Toxic to fish, aquatic invertebrates.
Carbaryl		✓	✓ Highly toxic to fish and other aquatic organisms, including amphibians.
Chlorpyrifos	✓	✓	✓ Very highly toxic to freshwater fish, aquatic invertebrates and estuarine and marine organisms.
Cypermethrin		✓	✓ Toxic to fish.
Deltamethrin	✓	✓	✓ Toxic to fish.
Dichlorvos		✓	✓ Highly toxic to birds and aquatic organisms.
Dinotefuran		✓	✓ Highly toxic to estuarine and marine invertebrates.
d-Phenothrin (Sumithrin)	✓	✓	✓ Toxic to fish.
D-trans-allethrin		✓	✓ Toxic to fish.
Esfenvalerate	✓	✓	✓ Toxic to fish and aquatic organisms.
Etofenprox	✓	✓	✓ Toxic to fish.
Imidacloprid		✓	✓ Toxic to aquatic organisms, birds.
Lambda-cyhalothrin		✓	✓ Toxic to fish.
Malathion	✓	✓	✓ Toxic to aquatic organisms, including fish and invertebrates.
Naled	✓	✓	✓ Toxic to aquatic invertebrates.
Permethrin[v]	✓	✓	✓ Toxic to fish.
Prallethrin	✓	✓	✓ Toxic to fish.
Pyrethrins	✓	✓	✓ Toxic to fish.
Resmethrin[vi]	✓	✓	✓ Toxic to fish.
Tau-fluvalinate			✓ Toxic to fish.
Tetramethrin		✓	✓ Toxic to fish.
Zeta-cypermethrin		✓	✓ Toxic to fish.
Other			
MGK-264 (synergist)			✓ Toxic to fish and aquatic organisms.
Mineral oils (surface film)			Not documented.
Piperonyl Butoxide (synergist)	✓		✓ Toxic to fish and aquatic organisms.

[i] These include chemicals available over the counter or used by commercial applicators.
[ii] These products can be used for community Ultra Low Volume (ULV) spray programs for vector control, both as aerial and ground spraying.
[iii] EPA's list of registered active ingredients that meet the acute toxicity criteria. Taken from *EPA's Proposal to Mitigate Exposure to Bees from Acutely Toxic Pesticide Product*. Docket Number: EPA-HQ-OPP-2014-0818.
[iv] Honey bee larvae more sensitive.
[v] Permethrin is also used for treated clothing.
[vi] Resmethrin was voluntarily cancelled in Dec 2015, but existing stocks may still be used until they are exhausted.

two synthetic pyrethroids in particular, phenothrin and prallethrin, used primarily to manage mosquitoes, stood out as posing exceptionally high risks to honey bees throughout the sampling period and across all sites, with risk values consistently greater than 5%. Permethrin can persist in sediment, soil, and plant tissue for weeks to months and has a half-life on plants of about 35 days.[42] According to studies reviewed by EPA, applications of permethrin formulations are likely to reduce the numbers and possibly eliminate populations of beneficial insects.[43] Further, pyrethroids in general are highly toxic to both freshwater and estuarine aquatic organisms.

C. Insect growth regulators, larvicides and surface films

Larvicides, many of which are insect growth regulators (IGRs), and surface films are also used as part of mosquito control programs to target juvenile mosquitoes. IGRs disrupt the juvenile life cycles of insects. Larvicides are applied to the breeding habitat (pooled surface waters, e.g. lakes, marshes, shallow ponds, etc.) to kill mosquito larvae before they can mature into adult mosquitoes. Commonly used larvicides include the synthetic methoprene, and biologicals spinosad, *Bacillus thuringiensis israelensis* and *Bacillus thuringiensis sphaericus*. Their use does not appear to impact honey bees, even though the IGR methoprene is toxic to certain aquatic organisms and invertebrates at the larval stage. Studies have observed physical malformations in adult bees exposed during the larval stage, and bee larvae are sensitive to the effects of methoprene and other IGRs.[44] Another larvicide,

Beekeeping During Mosquito Spraying

Mosquito spray programs differ by state in terms of pesticides used, application methods, and notification. It is important for beekeepers to be familiar with the mosquito spray operations in their locality. Contrary to what is said by mosquito officials, mosquito pesticides can linger in the environment for long periods of time, exposing bees long after spraying is completed. To protect managed bees from direct spraying, beekeepers can:

Stay Informed. Keep up-to-date on mosquito spraying. Information may be listed in local newspapers, or on local radio and television programming. Contact your local health department or mosquito control program and let them know you are concerned about the dangers of the mosquito control spray program. Some cities offer beekeepers the opportunity to "opt-out" of mosquito spray applications.

Cover Hives. While not entirely protective, entire hives can be covered to prevent pesticide drift into and onto the hive. It is recommended to use wet burlap or other breathable material, and it is important to cover the entrance to prevent foragers from going out during spraying.

Move Hives. Moving hives to a location where pesticides are not being applied is another option. If viable, move them at least two miles away to prevent bees from attempting to return to their previous location. However, moving bees may reduce exposure risk during spraying, but as discussed, residues can linger in the environment and can still potentially pose risks when hives are returned.

While there are some steps beekeepers can take to reduce risks to their hives, wild, native bees do not have such protections and remain at risk. Mosquito spraying, even when conducted late in the day, can and do threaten native bees long after spraying is completed.

Photo by Cohee courtesy WikiMedia Commons.

temephos, an organophosphate, was once commonly used, but its registration was cancelled in 2011 with all remaining stocks to be discontinued by December 2016.[45]

Surface films or oils (monomolecular films) are also added to mosquito breeding habitats to disperse as an ultra-thin layer (one molecule in thickness) on the surface of the water. Their mode of action against mosquito larvae and pupae is physical rather than chemical. The film interrupts the critical air/water interface in the mosquito's larval and pupal development cycle, preventing suspension of the larvae and pupae at the water surface, and subsequently suffocating/ drowning them.[46] Unfortunately, certain other aquatic insects that dwell at the surface of water, or those that must make contact with the air-water interface to breathe, can also be negatively affected.[47]

Nevertheless these larvicides, when used as part of a sound mosquito management strategy, can be very effective and may pose the least impact to non-target organisms and the environment.

Systemic, environmental residues prolong exposures

The impacts of mosquito spraying on pollinators can be felt long after spraying has ended. Pesticide residues on vegetation, surface waters, soil and hives, which can last from several hours to months after application, results in continued exposure for non-target organisms. Other local environmental conditions can also prolong the elevated presence of these pesticides in the environment. Johanson (1977) notes that the residual action of insecticides is increased, affecting many more bees the following day when colder nights following hotter summer days cause condensation of dew on foliage.[48] Johanson also points out that regional differences in climate can influence the toxicity of a given pesticide to bees. For example, malathion's effect on bees in warm California can be more deleterious than in cooler Washington state.

Since several pesticides are systemic in nature, meaning they are absorbed into the vegetation and expressed in pollen and nectar, have long half-lives in soil and water, and can bioaccumulate up

Nuisance vs. Disease Carrying Mosquitoes: How Communities Reach a Decision to Spray

Community mosquito-spraying varies by state and locality. Many states allow spraying by mosquito abatement districts, which operate based on perceived need, only during periods when there are public health concerns and mosquito-transmitted diseases are high. Many mosquito control programs respond to biting or sighting complaints by spraying to kill adult mosquitoes, usually at a higher threshold level than what is acceptable for public health sprays. However, with the continuous news coverage on the threat of Zika, many communities are quick to react, despite the fact that there have been no reported mosquitoes in the U.S. that are infected with the virus. Given the potential health risks and environmental impacts of adulticiding, monitoring and prevention techniques must be heavily emphasized, and spraying purely to control nuisance mosquitoes should be avoided. Public awareness should also be used to raise the bar on tolerance levels and to educate on the most effective means of mosquito management in the community and in yards. At a minimum, citizens must have the right to prevent pesticide spraying around their house or neighborhood and advance notification if spraying takes place.

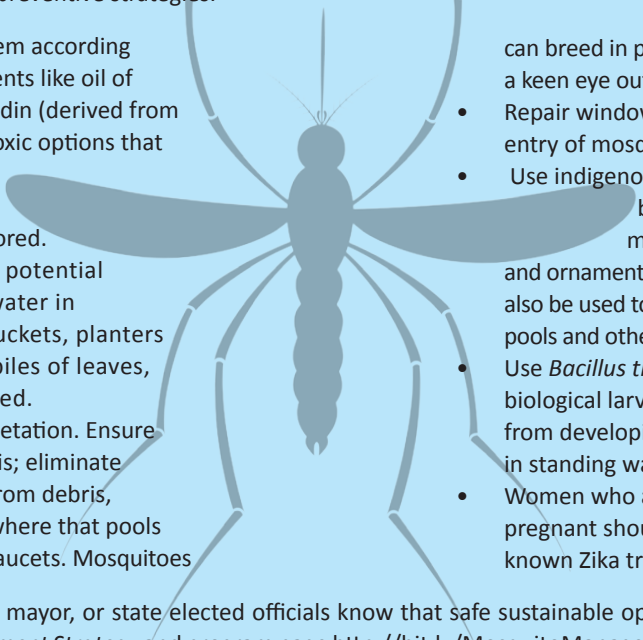
Beyond Pesticides advocates that spraying should only be done as a last resort after preventive measures, and after carefully evaluating the likelihood of virus transmission, pesticide-related illnesses, and the contributing factors to a human epidemic of mosquito-borne diseases. Contributing factors to a decision to use adulticides include: the public tolerance level of mosquito-disease and exposure to pesticides, ecology of the mosquito and disease transmission, the prevalence and types of mosquito and host species found in the area, and weather patterns. Specifically, this will involve:

1. Identifying local species capable of vectoring the disease;
2. Distinguishing between nuisance mosquitoes and vector species;
3. Virus surveillance through testing of dead birds, sentinel species, and mosquito pools to see if mosquitoes in a given area are at high enough thresholds to vector the disease; and
4. Various mosquito-trapping methods that indicate densities of females, species and virus.

Often, spraying occurs in response to a high number of mosquitoes or the finding of a "positive" –either a positive mosquito pool, a positive bird or a positive human case. However, as mosquito species and vectors can vary in different areas, and as larval control is considerably more efficacious, it is critical to have a good understanding of the ecology and the stage of mosquito development prior to beginning any spray program.

Protecting Yourself and Your Community from Detected Mosquito-Borne Diseases

Pollinator protection should not be forfeited for mosquito control. Beyond Pesticides believes the ideal mosquito management strategy comes from an integrated approach that emphasizes education, aggressive removal of standing water sources, larval control, monitoring, and surveillance for both mosquito-borne illness and pesticide-related illness. These practices minimize risks to pollinators and other beneficial species. Control of disease-carrying mosquitoes can be successful when emphasis is placed on public education and preventive strategies.



- Use repellents and apply them according to label instructions. Repellents like oil of lemon eucalyptus and picaridin (derived from pepper) are the best least-toxic options that maintain high efficacy.
- Wear long sleeve shirts and long pants that are light-colored.
- Check your yard and other potential sites weekly for standing water in containers such as tires, buckets, planters and even bottle caps and piles of leaves, where mosquitoes can breed.
- Cut back any overgrown vegetation. Ensure waterways are clear of debris; eliminate pooled or stagnant waters from debris, containers, drains, and anywhere that pools water. Watch out for leaky faucets. Mosquitoes can breed in puddles the size of dimes, so keep a keen eye out for stagnant water!
- Repair windows and door screens to prevent entry of mosquitoes into homes.
- Use indigenous fish populations, like bluegills or minnows, to eat mosquito larvae in shallow waters and ornamental pools. Copepod crustaceans can also be used to eat mosquito larvae in ditches, pools and other areas of stagnant water.
- Use *Bacillus thuringiensis israelensis* (Bt), a biological larvicide that prevents mosquitoes from developing into breeding, biting adults, in standing waters that cannot be drained.
- Women who are pregnant or might become pregnant should avoid travel to areas of known Zika transmission.

Let your local council members, mayor, or state elected officials know that safe sustainable options exist. Beyond Pesticides' *Public Health Mosquito Management Strategy* and program page http://bit.ly/MosquitoManagement has a list of resources that can help you and your community safely manage mosquitoes, including least-toxic mosquito repellents, and proper clothing that can be used to keep mosquitoes safely at bay.

the food chain, non-target organisms suffer primary and secondary exposure risks from pesticide applications. Residues outside hives post-application have also been suspected as a significant source of bee mortality. That is, bees resting in front of hive entrances are exposed to lethal residue deposits.[49] In addition to contaminated pollen and nectar, residue deposits on plant surfaces can create contact exposure hazards to pollinators after initial spray application. The half-lives of pesticide residues on plant surfaces and other environmental compartments vary considerably. Malathion, for instance, has a half-life on plant surfaces of one to nine days,[50] while permethrin is upwards of 35 days.[51] Naled generally has a half-life of less than two days in soil and water, while phenothrin can stick around in soil for about 26 days.[52]

Bees and other non-target organisms drinking contaminated water, burrowing into soil, or walking across plant surfaces will inevitably come into contact with pesticide residues for days or even months after the initial spray application.

Conclusion: Can we protect pollinators and manage mosquitoes?

Pollinators are important to our food supply and ecosystem. With unprecedented losses, it is important that we minimize threats to their long-term survival. While mosquitoes can pose serious public health threats when they carry diseases like Zika, West Nile virus and others, we cannot let an overzealous response to these threats endanger pollinators, the environment and human health. Aerial and ground spraying of pesticides over large areas of land has not only been shown to inadequately control mosquito populations, but pose risks to a large variety of organisms. Common mosquito pesticides, like malathion, naled and the pyrethroids, are highly toxic to bees, other insect pollinators, as well as birds and aquatic organisms.

Widespread spraying is not a solution for these mosquito-borne diseases. These methods fail to sufficiently control mosquito populations, promote pesticide resistance, and kill other species that act as natural predators to mosquitoes. In our attempts to stave off these diseases, we inadvertently harm ourselves, non-target organisms and overall ecosystem biodiversity. We can protect pollinators and manage mosquito populations at the same time. A measured approach is needed for managing mosquitoes that first involves an understanding of the mosquito's lifecycle, reducing breeding sites, and targeting larval populations. Control of disease-carrying mosquitoes that does not endanger pollinators can be successful when emphasis is placed on public education and preventive strategies.

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

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Introducing: The Mosquito Doorknob Hanger

Tips on speaking with neighbors on backyard and community mosquito control

A truck pulls up to your neighbor's house and out comes two people with backpack sprayers and face masks. They begin to drench your neighbor's yard with an unknown chemical as you hunker down in your house. You're very concerned, but still trying to muster the confidence needed to speak with your neighbor. Beyond Pesticides' new mosquito doorknob hanger may help.

Ideas on how to use the hanger

Start Small.

Most urban and suburban mosquitoes are weak fliers and will not travel far from where they breed. In order to see effective results, start small with your immediate, adjacent neighbors. Expand outwards, using your house as a central location. As the hanger says, "The more neighbors participating, the fewer mosquitoes there will be!"

Offer to help!

Maybe your neighbors are elderly or disabled and can't get out and eliminate breeding and habitat as often as needed. Offer your assistance by coming by at least once a week to dump out standing water on their property, or take turns with other neighbors participating in least-toxic mosquito control.

Take it to the halls of power.

Does your town spend money to spray toxic chemicals from trucks throughout neighborhoods in your community? After your neighbors start seeing the benefits of the simple mosquito reduction steps, get your group together and attend your community's next local council or mosquito control board meeting. Raise your collective voice against toxic pesticides that can harm people, pets, and wildlife in favor of least-toxic methods that focus on prevention and community education.

What about the nay-sayers?

More likely than not, you will encounter those who view pesticide use as a personal right. Many also fear the impacts of Zika, West Nile virus, and other mosquito borne diseases. Things could get heated. Don't let them. Stay calm and positive, and remain balanced and logical about the prospects for mosquito reduction without toxic chemicals. Emphasize to unsure neighbors that mosquito chemicals do more harm than good, especially for children and pets, and in the end are not worth the cost, given simple, inexpensive steps outlined on the doorknob hanger. Let them know that former renown professor Dr. David Pimentel (Cornell University) conducted a study on mosquito pesticide spraying which found that 99.999% of insecticides do not reach target mosquitoes, and instead spread into our environment, where they cause harm to public health, pets, and wildlife. Let your neighbors know that these simple steps become more and more effective as the community gets more involved.

Always encourage them to visit Beyond Pesticides information rich website on mosquito control at www.beyondpesticides.org/mosquito, where we go into more detail on the safe and effective strategies individuals and the community at large can take to prevent mosquitoes and the diseases they may carry.

Request a free pack of 25 doorknob hangers to distribute in your community today! Send an email to info@beyondpesticides.org with "Mosquito Doorknob Hangers" in the subject line, and include your name and mailing address, or call 202-543-5450.

Pollinators, Biodiversity, and Scientific Integrity

Heal the soil to solve the bee problem and biodiversity crisis

by Jonathan Lundgren, Ph.D.

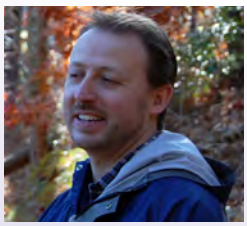
[Eds. note. The following are excerpts of a keynote talk that Jonathan Lundgren, Ph.D., the founder and director of Ecdysis Foundation (www.ecdysis.bio) and Blue Dasher Farm (www.bluedasher.farm) gave to the 34th National Pesticide Forum, Cultivating Community and Environmental Health*, in Portland, Maine, April 16, 2016. The complete talk can be found at http://bit.ly/Lundgren34NPF. The talk was introduced by Paula Dinerstein, Beyond Pesticides board member and senior counsel with Public Employees for Environmental Responsibility (PEER), which represented Dr. Lundgren in a whistleblower case in which he disclosed that the U.S. Department of Agriculture had suppressed his scientific work on pollinators and genetically engineered crops.]*

Introduction –Blowing the whistle with good science

by Paula Dinerstein, senior counsel, Public Employees for Environmental Responsibility (PEER), board member of Beyond Pesticides

I don't believe that Dr. Lundgren set out to be a whistleblower –he set out to do good science, his science came up with some results that upset certain interests in industrial agriculture. His employer, the U.S. Department of Agriculture (USDA), essentially turned against him. Until recently, Dr. Lundgren was a senior research entomologist and lab supervisor with the Agricultural Research Service of USDA in South Dakota. He worked there for 11 years with great success and his research received national and international recognition. However, in April of 2015, he published a study in *The Science of Nature*, which demonstrated that clothianidin, a neonicotinoid insecticide, killed the larvae of monarch butterflies in the laboratory.

Some months later in August, USDA imposed a 14-day punitive suspension on Dr. Lundgren. We believed it was for the trumped-up charges of submitting that study to the journal, and what they called "travel irregularities." There were minor discrepancies on his travel authorizations to address the National Academy of Sciences, and a USDA stakeholder group in Pennsylvania, the No-Till Alliance. Fairly recently, the Obama administration ordered all federal agencies to implement new scientific integrity policies. Dr. Lundgren filed a complaint under the scientific integrity process with USDA, but it was rejected, and we now have a lawsuit challenging certain aspects of that policy. The policy directs scientists not to say anything about their science that could impact policy, which is where Dr. Lundgren got in trouble. If you want to read more about him, there was a cover story in *The Washington Post* weekly magazine about him, entitled, "Was a USDA scientist muzzled because of his bee research?" Dr. Lundgren is no longer with the USDA. He left recently and has begun some very new and exciting endeavors, which he will tell you about. It is my great honor to introduce Dr. Jonathan Lundgren.



First, let me preface this presentation by saying that I frankly would not be here if it was not for PEER. So, I cannot say enough good things about PEER's work in supporting scientists behind the scenes. You don't see a lot of the help for scientists who need it, and, like me, never expected to be in a situation like this. One important aspect of my research program is trying to get at very complex ecological questions underlying how we assess risk reliably within a realistic context. The other aspect of what I do is the development of solutions that can replace the use of pesticides with ecological principles, which probably appeals to a lot of folks in the organic sector, but not exclusively the organic sector.

Pesticide Safety: Are we asking the right questions?

What a great meeting –the 34th National Pesticide Forum, *Cultivating Community and Environmental Health*. This is exactly the kind of meeting that we need to be having. It's not just focused on pesticides as bad for society, but also providing solutions. Because there is either a real or perceived need for these pesticides. Without filling that need with the use of alternative methods, then really we're having a discussion that's not going to lead to solutions.

In 1948, Paul Müller, Ph.D. received the Nobel Prize for Medicine. He discovered a chemical that was cheap to produce, very low in mammalian toxicity, and was blindingly effective at killing insects. This was a game-changer folks. It saved millions of lives. It tipped the balance in our favor because, prior to this, insects had really come to have serious deleterious effects on the human race. Insects had killed more soldiers than bullets or bombs. Until these early insecticides came along, diseases literally turned the tides of war. We started

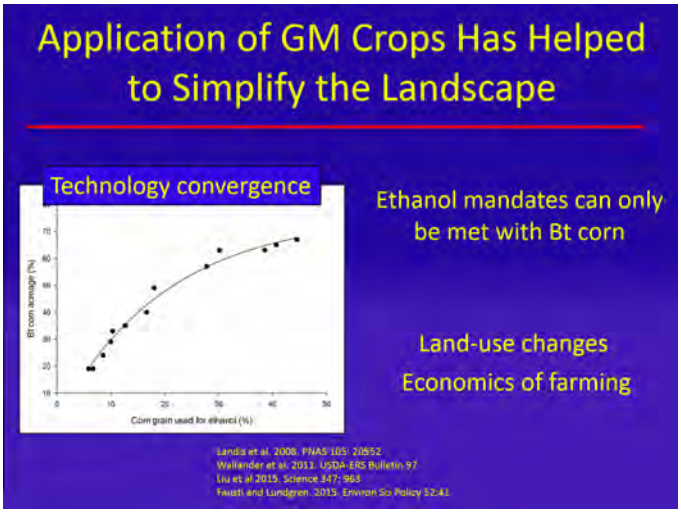
spraying it in our houses. We started spraying it in our wetlands. There was actually a World Health Organization (WHO) sanctioned mosquito eradication program for the entire planet, where we used DDT-like pesticides trying to eradicate mosquitoes from the face of the earth. It did not work by the way. Nevertheless, we used it without thoughts of consequences, because now we had a tool. Farmers no longer had to think about things as far as insect management was concerned. They could simply react as a pest became problematic.

Dr. Lundgren speaking at the 34th National Pesticide Forum in Portland, Maine in April 2016.

But, there *were* concerns. There were problems that started to arise, many of which we are still uncovering today. There are harmful environmental effects. We're still finding DDT and the other organochlorine pesticides in tissue, even within the human population. Our large apex predators were eliminated, some driven to near extinction. Some of these organochlorine pesticides weaken the eggshells of birds, and they bioaccumulate, so they are present at higher densities within some of these large predators. Incidentally, we're starting to see declines again in some of these large raptor populations.

Of course, there were a lot of human health problems, not just cancer, but also birth defects, diabetes, and brain damage –all linked to some of our pesticide uses. To add insult to injury, the pests themselves became resistant to the actual use of these pesticides. Insects are good at that. High reproductive rates, quick adaptability, strong selection pressures within the environment.

Are these chemicals inherently bad? Should Paul Müller have received the Nobel Prize for Medicine? I think it's easy to look back through history and say now we have information that says that there were some serious problems with the use of DDT. At the time, using the best technology of the day and the questions that we were asking suggested that this was a safe chemical. Does that mean that all of these chemicals are inherently bad, or should we presume that there are problems with them and use them as needed, with more of a precautionary approach? No matter what decision we make, there are costs and benefits to everything. Even doing nothing at all has a cost and a benefit. The question is how do we measure these costs and benefits effectively?



Slide: Bt technology has become an integral part of a corn-dominated food production system, which has had consequences on biodiversity, ecosystem functions, and the economics of farming throughout the country.

This is a very important issue because ecological risk assessment is really hard. We are trying to prove a negative, and all it requires is a single example. Switching the question around can reveal that our presumption of safety was erroneous all along. So, we rely on a preponderance of evidence, but the preponderance of evidence is only as strong as the questions that we are asking with our risk assessment. It is only as strong as our technology allows us to measure risks in the environment.

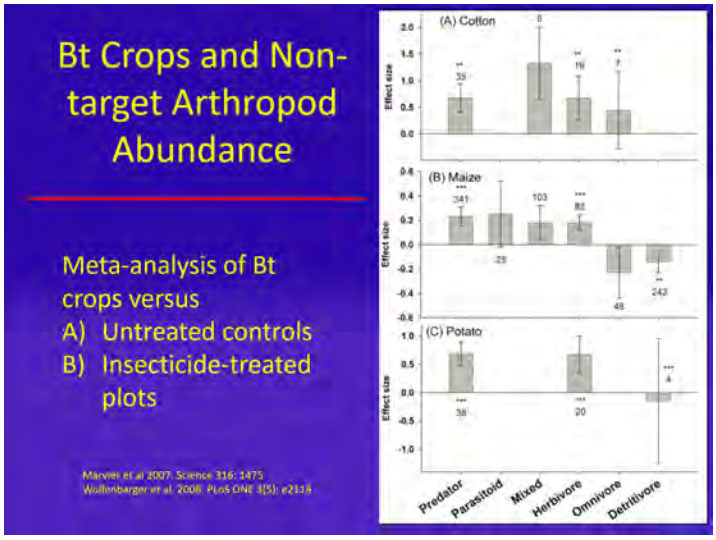
Genetically engineered Bt crops as insecticides

Bt crops raise a great question –do they pose an extraordinary risk to the environment? Bt crops are genetically modified to incorporate a gene from entomopathogen, which is an insect disease that expresses itself from root to pollen. It tends to be fairly specific for particular insect groups, especially key pests of the crop plant itself. This was really a game-changer, in terms of risk assessment and from the environmental standpoint. Whether you love them or hate them, genetically modified crops are here. There is a lot of public interest in ensuring their safety because there's a lot of fear that's associated with them. Should we be genetically manipulating and inserting foreign genes into our food production system?

There is a war being waged on genetic engineering in the public that was driven a lot by the monarch butterfly. Bt crops really represent a paradigm shift back to a prophylactic pest management strategy. For a number of years, after EPA was established, integrated pest management (IPM) emerged, as farmers started to go out into the fields and sample for pest problems, and only use pesticides when they had a problem. With Bt crops, by putting all of the insecticides right in the bag, the farmers no longer had to think about it anymore.

They were investing in a pest management strategy whether or not they needed it. We know that's a bad business decision. If you know you're going to have a pest problem annually, then maybe it's worth the investment. However, this was a slippery slope because it opened the door for a lot more prophylactic pest management.

Risk assessment is only as strong as the questions that we ask. Are pesticidal Bt crops toxic to non-target organisms (non-human)? Do Bt crops reduce the abundance of non-target organisms in the field? Abundance is a proxy for all kinds of different fitness effects. A reduction in abundance could be caused by a reduction in fecundity or reproductive rates, reduced longevity, outright mortality, or it could be biological dispersal. All of these things should be housed within this one proxy of abundance in the field, arguably.



Slide: The baseline is an untreated crop. In nearly all cases, Bt had little effect on non-target arthropod guilds.

We have hundreds of published studies in the system on this. I was actually part of a meta-analysis looking at effects of Bt crops on non-target arthropod abundance in the field. It was done on Bt cotton, Bt corn, and Bt potatoes. We examined different functional groups of insects –predators (lady beetles, parasitoids (largely wasps)), herbivores eating plants, omnivores eating plants and insects, and soil dwellers. Using an untreated control as the baseline year, we found a bunch of studies on the primary parasitoids (beneficial predators) of the European corn borer, which were eliminated with the Bt corn. There's a general borer reduction, but none of it is significant, except for predators in cotton. In potatoes, you can actually see an increase in some of these pressures.

We also studied the insecticides because there's a cost and a benefit to every decision. If Bt is not used, then it's possible that insecticides would be used to replace it. What we find is that, in this case, Bt crops are almost always better than the insecticides that they're supposed to be replacing, except for, oddly enough, omnivores and detritivores (such as earthworms, which eat decomposing plants and animals). *Collembola*, little springtails, which are jumping around in the soil, are actually reduced more in corn systems by the Bt than by insecticide use. [*Collembola* contribute to soil health, aid in plant update of soil nutrients, and control fungal diseases.]

Suppression of science on Bt effects

Based on the available data, Bt crops seem to have a minimal toxicological effect on non-target organisms in the laboratory as well. But, I qualify that by attaching the caveat 'based on the available data' because there are studies that have been suppressed that show an adverse effect. In fact, I wrote one of them. So, of the published literature, is there a file drawer of effects based on what these meta-analyses may not be capturing? It's very possible. Is toxicology the risk that we're worried about? There are some exceptions. Specialist natural enemies, such as parasitoid wasps –which are actually the most diverse group of animals on the planet Earth– instead of stinging people, use their stingers to lay eggs inside other insects.

The claim that Bt crops have reduced insecticide use has been debunked. This is true, not because Bt crops require additional insecticide use, but because the paradigm shift to prophylactic pest management led to an increase in marketing and sales of other insecticides that became necessary with this approach. We actually see that neonicotinoids are now used on the majority of cropland acres. In corn, soybean, and cotton plantings, we are seeing a rise in insecticide use. Data from the National Agricultural Statistics Service does not capture this because it is not including the seeds treated with insecticides as well as some other chemicals.

Bt crops have been associated with the simplification of our land use, of our food production system. The ethanol mandates that were put forward in 2007 necessitate a certain quantity of ethanol be produced by plants. Corn is the only realistic source of this ethanol, so it has artificially increased the value of corn and resulted in more farmers abandoning other crop management strategies to focus exclusively on corn, as well as increasing corn acreage and taking non-crop habitat and planting it with corn. That's only possible with Bt corn because you can only plant corn, after corn, after corn, otherwise the pests just overcome you.

So the question is, "Are Bt crops safe?" We're asking the question, "Are Bt crops toxic?" The answer is probably no. Should we be asking the question, "Has Bt crops changed the natural environment in which we're living and increased our exposure to other insecticides?" Perhaps, not directly, but they all have been associated with this major change.

A problem with our food production system

Silent Spring, written by Rachel Carson, identified a critical problem and it was so influential. The results and the impact that this has had on our entire society and our whole perception of the natural environment is profound. At least personally, I don't think it went far enough. Pesticides should not be the focus of the problem. We focus so much on "let's get rid of these pesticides, let's point out all of the problems with pesticides." You know what, even if we banned all pesticides tomorrow, we're still going to have the same issues that we have today. This is not a pesticide problem. This is not a

bee problem. This is not any of these problems. This is a problem with our food production system. Until we revise, reform, transform our food production system, away from the simplified monoculture model, we are not going to solve these issues. That's what makes this conference so special. Let's figure out what causes pest problems to begin with, rather than always reacting to the symptoms as they start to outsmart us.

If we manage a healthy ecosystem, these pests are just not an issue as much anymore. That doesn't mean that I'm saying we should abandon all pest management principles. I'm not telling you to ignore your pests. If we use some very simple, conceptual ideas, we can dramatically reduce our reliance on pesticides –profitably. We can reduce disturbance and increase diversity in our food production systems, and reduce disturbance that kills soil. Disturbance kills the biology of the soil.

> ***"Let's figure out what causes pest problems to begin with, rather than always reacting to the symptoms as they start to outsmart us. If we manage a healthy ecosystem, these pests are just not an issue as much anymore."***

Step one in this process is to reduce or eliminate tillage. Soil biology is the basis upon which our food production systems relies. When you till, you extirpate all the natural biotic resistance to pest proliferation. You come in and plant thousands of acres of a single plant species that is genetically limited to producing a large seed that we like to eat. The primary pest arrives and the soil no longer has any biotic resistance to its proliferation, so you must replace biodiversity with a chemical. That is the pesticide treadmill in a nutshell.

The next thing is that energy gets into our food production system via photosynthesis. Photosynthesis is produced by plants. We need more vegetation diversity within our food production systems in order to provide and feed the rest of the biodiversity in that system. There are agronomically proven ways of doing this.

In South Dakota, we have the corn-snow-corn rotation. That is not diversity. The science is clear on this. We need to be extending these out to 4-5 year rotations, oftentimes with a perennial phase. That is the most resilient to profitable rotation in the long run of food production systems. When you have 30-inch rows, you have 30 inches of bare soil. We need to be filling that up with intercropping. We need to be feeding it and capturing the energy down into the soil. We need to be using cover crops in the fallow period. We need to be covering the soil and having roots in the soil. We need to be connecting growing seasons so that we don't extirpate the biology from our food production system. Field margins and conservation strips are tools for us. Weeds have a role to play. A zero tolerance policy towards weeds is not okay.

Production without insecticides

I'm traditionally trained as an entomologist that reacts to pests. But, I always questioned this in the back of my mind, and I started to interact more with farmers who are doing things differently. In Colorado, they are growing potatoes, which is an insecticide-intensive crop. Brendon Rockey, in Alamosa, CO, hasn't used insecticides in 20 years. He uses a pivot corner (patches of land beyond the reach of irrigation) for conservation strips. He actually plants cover flowers into his potato rows while he is planting. Then he's eliminated one phase, the barley phase, of his rotation and, instead of having that second crop, he plants a green manure (cover crops that add nutrients and organic matter to the soil) that he then grazes. By taking that second crop out of the rotation, he's actually increased the profitability of his long-term operation because he no longer needs fertilizers or insecticides during the potato phase. He's looking at the longer term, rather than just a single season at a time.

In Burleigh County, North Dakota, there is so much regenerative agriculture going on, it is really profound. Gabe Brown from Bismarck, North Dakota hasn't used insecticides in 26 years. Dwayne Beck, from Pierre, South Dakota, doesn't use insecticides. He will use Bt, simply because he can't find corn seed that doesn't have it. Then, there is Dave Brandt from Carroll, Ohio. He actually has his own soil type. He's changed his soil over the last few decades using no-till and covers, and he now has on his farm a soil type that has never been defined before. When I was having breakfast with him, I asked him, "When's the last time you used insecticides?" He said, "Oh, it's been about seven years. Oh, except for that one 10-acre field" [of corn]. I asked, "Why do you do that?" He says he puts a neonicotinoid seed treatment out there because his agronomist told him that all of his neighbors get a

six bushel yield bump. And I asked him if he saw this and he said, instead, he sees a nine bushel yield drag. I asked, "Well, why do you do that?" And he said, "Well, to prove that my agronomist is full of crap." When you change the soil and when you restore the soil biology, you find that it doesn't behave by the same rules. The same rules do not apply any longer.

Heal the soil, protect bees

This talk is about pollinators and I will tell you the solution to the pollinator crisis. It's not about varroa mite. It's not about the diseases, and it's not about the pesticides. Heal the soil and you will solve the bee problem. These issues are not just a bee problem. This is a biodiversity crisis that we are facing right now. We've lost wetland habitats. Entire habitats are diminishing rapidly. We're currently living in the Holocene extinction event, which is one of the most severe extinction events that the planet Earth has ever experienced throughout geologic history. The data is pretty clear on this. We are losing species at a rapid rate. Where did the prairie go? Insect communities are being lost. Butterflies, birds and bats. Come on, wake up! Let's connect the dots.

Challenging paradigms

To sum up, a little bit about science. It's our job to ask questions. Sometimes the answers to those questions are inconvenient. Throughout history, whenever we've asked, or scientists have challenged, the current paradigm, if the paradigm is big enough, that scientist tends to experience problems.

Rachel Carson certainly is a great example. She persevered, and perseverance like that is so important, as far as advancing our society. The formation of the U.S. Environmental Protection Agency and the *Federal Insecticide, Fungicide, and Rodenticide Act* are related to this lady who was ostracized. So, I've thought about this many times over the last few years. I went from being one of the golden boys of science. I was elected one of the top young scientists in the country. I got to meet President Obama in the White House. Then, the farmers and the beekeepers were seeing things in their operations that oftentimes defied science or it was exactly contrary to science. They were doing things on their farms that science said couldn't happen. They were seeing effects of pesticides that science was saying wasn't happening. So, I decided to devote my expertise to answering those questions. And those questions challenge the current paradigm of food production. Why this shift from golden boy to pariah within the USDA? Was it because of the questions? Was it because I changed the way I was presenting it so that people would actually understand what it is that I was trying to say? I don't know.

I think it ultimately comes down to fear. There's a lot of fear within USDA. That fear prompts good people to do bad things. I can tell you that things like integrity, perseverance, and strength were the motivation or the driving factor behind blowing the whistle like I did. But there's always an element of doubt. The motivation in making a disruptive decision, as I did, is really important, because there are consequences. I sacrificed a very long, comfortable, and promising career with USDA based on my decision. Everybody that I care about in my life was hurt because of my decision. Friends don't talk to me anymore. People that I care about despise me because I made this decision. But then on the flip side, there are people like yourselves [conference participants], and the support has been very strong, and I do appreciate that. I don't hold it against anybody for not wanting to go the whistleblower route, because there are a lot of scientists that have been in the same place I was and didn't make the same decision I did. Part of the reason I ran into so much trouble is because they didn't stand up to the tremendous pressures that you end up going through by going down this path. In fact, on Thursday morning, I met with a colleague who said that part of his annual duties is to make his boss look good. That's part of his scientific duties now, working for USDA. Yes, it bothers me, but at the same time, his motivation is that he has a family at home and people in his lab who are depending on him for their employment. What is my motivation? There's two really good reasons, my kids and yours.

Supporting beekeepers and farmers with research

I believe that the only way that we can really solve some of these planetary scale problems is by having open and respectful discourse on these issues. In seeing a lack of scientific support for the people who are trying to innovate our food production systems, I've taken a new path. We have founded a non-profit, Ecdysis Foundation and Blue Dasher Farm. Ecdysis means metamorphosis, shedding the old skin in insects. It's a geeky entomological term and it is very applicable. Blue Dasher is a dragonfly species. We are starting an initiative, Centers for Excellence and Regenerative Farming Principles. We hope to establish a nationwide network where we pair cutting-edge research and science with education, training the next generation of scientists and farmers. We want to manage a demonstration farm, because seeing is believing. That is what we are doing right now.

We've said to the farmers and the beekeepers, if you believe in this, consider supporting it. They did. They bankrolled the research lab. I don't believe that's ever happened before. We need to figure out how to crack this nut. Thirty-five percent of the terrestrial land surface of our planet is devoted to food production systems. That means conservation of species needs to happen and involve farmers. No good scientist is able to present without the tremendous support of a fine group of young and enthusiastic scientists. My research team is fantastic and a lot of them are coming with me to the new Blue Dasher Farm initiative. If I wasn't here right now, I'd be at home building beehives, getting the farming operation up and running, and getting the lab all built up. We're actively getting going. We've been open for about a month and a half. Alright, that's all I got!

Get the Data You Need to Power a Local Movement

Advocating for change is difficult when you don't have the facts. If you've decided to work toward pesticide reform in your community, the following questionnaire on current pest management practices for green spaces can help you start a dialogue and build a relationship with local land managers. Answers to the questionnaire will help educate the public on what's working well, and where the community can provide support. Deliver this questionnaire to the local agency that manages public green spaces, such as the public works or parks and recreation department.

You or an individual in your advocacy group may have seen public land managers spraying pesticides at one time or another. But do you know what they've sprayed, or the steps they took before they sprayed? It may be that they're using a least-toxic organic compatible product as a last resort, and not a hazardous synthetic pesticide. The first two questions are intended to help provide the community with an idea of the steps land managers take to manage common insects and weeds, and determine how much pesticide is used, and where. The answers to the questions will help open the dialogue on improving or reorienting land management practices toward a natural systems approach. If public officials are not practicing organic methods, but would consider them, you've got a great goal to work toward. Lastly, if the government doesn't have public pollinator gardens or wildlife habitat, you could work with them to organize a day to plant a pollinator garden, or restore degraded habitat.

The last thing we want the questionnaire to be is a point of contention between advocates and community land managers. There certainly are other ways of acquiring the information. For example, information on pesticide use in the community can be obtained by a local public records request, but we hope that this questionnaire is delivered and received with good intentions and can serve as the foundation for a healthy relationship. If you have any questions or need organizing assistance, please contact Beyond Pesticides by sending an email to info@beyondpesticides.org, or calling 202-543-5450. And please let us know how your local government responds!

Questionnaire:
Current Pest Management Practices on Green Spaces

The purpose of this questionnaire is to provide the public with a general idea of current community pest management practices. Answers to these questions will help to educate residents about the challenges and opportunities regarding pesticide use. Thank you for providing the public with this important information.

Pest Management Policy
Please provide a copy or link to current pest management policy for the community. Otherwise, please attach or outline the government's pest management approach:

_____
_____
_____

1. **What pesticides are used in the community, and where?** *Please attach a list of pesticide products, their active ingredients, and locations where they were applied within the last year.*

2. **What cultural practices are employed for public green spaces?** *Please check all that apply.*
   ☐ Soil tests ☐ Aeration ☐ Overseeding ☐ Dethatching
   ☐ Compost ☐ Topdressing ☐ Careful Watering
   ☐ Compost Tea ☐ Mowing above 3 inches
   ☐ Other *(please describe)* _____

3. **Does the government provide or encourage training in natural or alternative land management practices?** *If not, is this something it would consider?*
   ☐ Yes ☐ No ☐ No, but would consider

4. **Does the government currently use natural/organic pesticides and fertilizers?** *If not, is this something it would consider?*
   ☐ Yes ☐ No ☐ No, but would consider

5. **Concerning weed and insect control, is more staff time dedicated to:**
   ☐ Pesticide Use, or ☐ Mechanical/Non-Toxic Pest Control?

   *If pesticide use, why?*__
   _____
   _____

6. **Does the government have public space dedicated to pollinator or other wildlife habitat?**
   ☐ Yes ☐ No ☐ No, but would consider

Thank you for educating the community about current pest management practices!

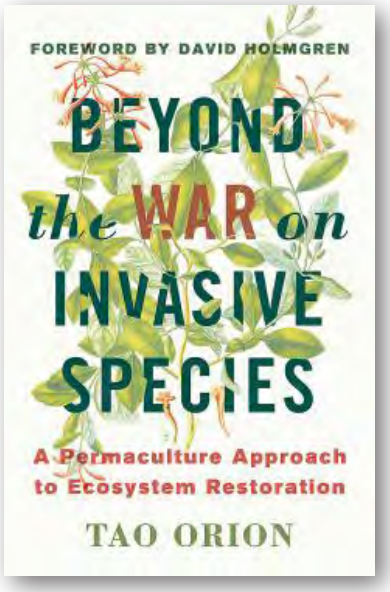
by Terry Shistar, Ph.D.

Beyond the War on Invasive Species:

A Permaculture Approach to Ecosystem Restoration

Beyond the War on Invasive Species, Tao Orion, 2015, 272pp.

Tao Orion is a permaculture designer, teacher, homesteader, and mother living in the southern Willamette Valley of Oregon. Her interest in integrating organic agriculture, sustainable land use planning, ethnobotany, and ecosystem restoration is evident in this book. Like all good ecologists, her thoughts and writing are nonlinear, weaving together, rather than stringing together, diverse ideas.



Beyond the War on Invasive Species is not a polemic. It discusses particular "invasive" species in relation to ecological principles and processes, not to establish a particular viewpoint, but to explore possible explanations and future actions. The book thus explains ecology and permaculture using invasive species as examples.

The "invasive species problem" cannot be understood by means of arguments based on correlations, purporting to show that invasive species are the "second greatest threat to biodiversity." Instead, we need to understand ecological processes, like disturbance, colonization, succession, herbivory, predator-prey relationships, and resource flow in ecosystems, as well as how and why those species labeled "invasive" have come to perform ecosystem functions once filled by "native" species. (An appendix lists many species that moved from continent to continent (or island) before 1492.)

An important historical paradigm shift indicated by this book is the acknowledgement of humans as a part of nature. Other authors have pointed out that pre-Columbian America was not the wilderness described by later observers like John Muir because indigenous Americans, who had helped shape the ecological communities, had been decimated by disease and extermination, leaving the ecosystem to evolve without their strong influence. *Beyond the War on Invasive Species* reveals that the loss of indigenous humans in many ecological communities was the loss of a community member, a disturbance comparable to the loss of another keystone species. In contrast to indigenous peoples who viewed themselves as part of nature, our culture regards nature as being separate from humans. This change in worldview is critical to the premise that invasive species are a problem, rather than a symptom of changing conditions.

The author also identifies permaculture principles as important guidance to a way forward –a way that uses invasive species as allies in solving problems, pointing out the contradictions inherent in the conventional view: "Rampant growth of invasive species is seen as threatening to ecosystems, when turning diverse ecosystems into monoculture crops destined for human or [domestic livestock] animal consumption is considered normal." In moving forward, she suggests, for example, using zebra mussels in cleaning up PCBs, giant reed to fulfill the hydrological functions once performed by beavers, knapweed buffer strips to intercept phosphorous pollution, and managing invasive nitrogen fixers to provide nutrients for crop plants.

In the chapter "Everyone Gardens," the author shows how indigenous inhabitants of the land fostered biodiversity by planting and otherwise encouraging diverse edible, medicinal, and otherwise useful plants. "Invasive species are not only a result of modern land use practices but also a result of the absence of tending native plant and animal communities." Permaculture is based on an ethical foundation requiring that decisions and actions: "care for the planet, care for people, and reinvest surplus energy, money, and other resources into regenerative systems." And from a practical perspective, "The principles of permaculture design are, at root, a compendium of wisdom gleaned from the techniques and practices of indigenous societies throughout the world, applied to the modern context."

Moving forward, solving problems requires a change of worldview. "The first step in this holistic approach is to acknowledge ourselves as part of a web of relationships in which every action has consequences throughout the ecosystem where we live, from our immediate vicinity to the entire biosphere." It requires that we acquire a sense of place –we need to feel a part of the place where we live. What is unnatural is not so-called "invasive species," but monoculture and dramatic simplification of ecosystems.

Watch Videos to Inspire Change from the 34th National Pesticide Forum at bit.ly/Videos34NPF

Jonathan Lundgren, Ph.D., agroecologist, director, ECDYSIS Foundation, CEO, Blue Dasher Farm

Chip Osborne, horticulturalist, owner, Osborne Organics, board member, Beyond Pesticides

George Leventhal, Landmark Lawn Pesticide Ban Sponsor, Councilmember, Montgomery County, Maryland

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PROTECT POLLINATORS ALL YEAR LONG!

Made by Pollinators

A BEE Protective Campaign launched during National Pollinator Week

For **National Pollinator Week 2016**, Beyond Pesticides and the Center for Food Safety teamed up with DC-area restaurants to increase consumer awareness and action to protect pollinators by showcasing menu items or creating menu specials featuring ingredients that rely on pollinators for production. These restaurants, which included *Busboys and Poets, Founding Farmers, Lavagna, Restaurant Nora* and the *Tabard Inn*, leveraged their organic, local and ecological practices to teach patrons about pollinator declines and encourage them to get involved in protecting vulnerable pollinator populations.

Learn more or get involved as we spread the **Made by Pollinators** program nationally: http://bit.ly/MadeByPollinators.

BEE Protective