Testimony to the Vermont House Committee on Agriculture, Food Resiliency, and Forestry re: H.706 - An act relating to banning the use of neonicotinoid pesticides

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Thank you for inviting me to provide testimony on H.706. My name is Emily May, and I am a Pollinator Conservation Biologist at the Xerces Society for Invertebrate Conservation, where I am the lead biologist in the Pesticide Program advising our staff and partners on agricultural practices and pest management. I studied conservation biology at Middlebury College, where I first got into bees, then went on to receive a master's of science in entomology from Michigan State University, where I studied wild bee communities on highbush blueberry farms and how they respond to pesticide use and pollinator habitat plantings. My work with Xerces for the past decade has focused on conserving crop pollinators and other beneficial insects through habitat creation and protection from pesticides.

Xerces is a science-driven non-profit that is focused on protecting wildlife through the conservation of pollinators and other invertebrate species and the habitats they rely on. Invertebrates are essential to the world as we know it, they are the vital base to the food chain, and they provide many important services such as pollination, decomposition and recycling, and natural pest control. At Xerces, we work directly with a diverse mix of farmers and other land managers in Vermont and throughout the country to conserve beneficial insects. We are well versed in the importance of balancing pest management with environmental protections.

The overuse of pesticide-treated seed and its impact on pollinators, aquatic invertebrates, and other beneficial wildlife is an issue that Xerces has been tracking and reporting on for many years. Neonicotinoid treated seeds cause widespread contamination of air, soil, water, and plants, posing harm to pollinators, aquatic ecosystems, and other wildlife nationally and across Vermont. I'm glad to have the opportunity to speak with you today in support of H.706.

Importance of pollinators

Since its founding in 1971, one of our organization's major focal areas has been conserving and restoring the health of pollinator populations. Previous testimony has covered why pollinators are so valuable, but I'll reiterate that both managed and wild native bees are incredibly important for Vermont crop production and natural ecosystems. Over 80% of the world's plants rely on insect pollination for reproduction. Pollinators help build out the base of the food chain for many species.They are the glue holding our ecosystems together.

Unfortunately, pollinators like bees and butterflies are in decline globally, and Vermont is no exception. In addition to managed honeybees, Vermont is home to 350 different wild bee species. You heard testimony from Kent McFarland at the Vermont Center for Ecostudies, which reported that 55 of Vermont's wild bee species are in need of immediate conservation action.[1] Our bumble bee communities are significantly less diverse than they were in the 1990's. This means only a few species can be found in places where it was once common to find several.

Our native bees share some important similarities and differences from honey bees. The vast majority of Vermont's wild bees (~90%) live in the ground. These species excavate nests in the soil and their babies grow and pupate in the soil, which is important for how they're exposed to pesticides. Like the honey bee, wild bees can be exposed to pesticides as they're flying around, interacting with plants, and in nectar and pollen they collect and bring back to their babies, or consume during development. But the soil itself is also an important route of exposure for ground-dwelling bees, who use their mouths and legs to dig out those nests in the ground.

Pesticides are a major contributor to pollinator and other insect declines

Pesticides are considered a major driver of pollinator declines, along with other key threats including loss and degradation of habitat, diseases and competition from non-native species, and climate change. One of the things that drives our organization's emphasis on pesticide reduction is that pollinating insects actually face greater challenges from pesticides today than they did even 20 years ago. You have likely heard that the volume of insecticides applied to crops has gone down over the past few decades, and that that's a win for human health and the environment. You've heard repeated testimony that because neonicotinoids are applied at low rates in terms of pounds per acre, that means that they are a better option and lower risk than other chemistries applied at higher rates.

I want to make an important point here: **the amount or volume of a pesticide applied per acre is not a good indicator of its risk**. A highly toxic pesticide applied at very low rates can be more risky than a less toxic pesticide applied at higher rates. You can't say that something applied at 2 ounces per acre is going to be less risky than something applied at 10 pounds per acre, if the pesticide going on at 2 ounces an acre is 1000 times more toxic. That's where we are at with neonicotinoids.

The EPA classifies pesticides as highly toxic, moderately toxic, slightly toxic, and practically non-toxic based on their LD50, or how much of the active ingredient kills 50% of the test population of adult honey bees. Anything that has a 50% chance of killing an adult bee at 2 micrograms or less per bee is lumped together as "highly toxic." But the neonicotinoids clothianidin and thiamethoxam - the two most common seed treatment neonics[2] - are in the range of 500 to 750 times more toxic than EPA's threshold of being highly toxic to bees. It almost feels like there should be another category for something that is orders of magnitude more toxic than highly toxic.

An adult honey bee has a 50% chance of dying from ingesting less than 0.003 micrograms of thiamethoxam, which makes it more than 90 times more toxic to a bee than chlorpyrifos. For reference, a single grain of salt is about 60,000 micrograms. If you mixed a grain of salt's worth of thiamethoxam into the diet of 20 million bees, you would kill half of them. For pollinators, we

[1] Vermont Center for Ecostudies. State of Vermont's Wild Bees, 2022. https://stateofbees.vtatlasoflife.org/
[2] Lin et al. (2021) https://doi.org/10.1002/etc.4957

need to be thinking about dose and risk at the insect scale. Very trace amounts of these chemicals can lead to harm.

The total toxic load to honey bees in the US from insecticides has increased markedly over time even as overall insecticide use by volume has gone down.[3,4] Toxic load is a metric that is calculated from the total amount of insecticides used, their acute contact toxicity to honey bees, and their environmental persistence. As organophosphates have been phased out, neonicotinoid use has grown exponentially, including use as seed coatings, foliar sprays, and soil drenches. Neonic use comprises most of the increase in toxic load for honey bees from 1992-2014, when seed treatment use estimates were last released publicly.

Treated seeds are planted on over 140 million acres nationally and account for an estimated 10% or more of all insecticide use.[5] This is only an estimate, because a federal regulatory loophole exempts treated seeds from the same level of oversight as other pesticide products and the EPA does not track use. We are grateful that Vermont started requiring tracking and reporting of this usage, the only state currently doing so, although others are starting to follow suit.

Neonicotinoids are harmful and overused

Neonicotinoid insecticides have the particular combination of characteristics that make a pesticide particularly high risk to pollinators. Most neonics are highly toxic to bees, whether they're exposed on the outside of their bodies or ingest them in their food. They are systemic, meaning they move into plant tissues and can be expressed in pollen and nectar, where bees pick them up and feed them to their young. They are highly mobile in the environment, contaminating air, plants, soil, and water. Pollinators cannot avoid being exposed in a landscape full of contaminated plants.

Neonics are also persistent, sometimes remaining at harmful levels in woody plants and soil for months to years after they were applied. Untreated plants that grow in areas formerly treated with neonicotinoids, such as cover crops that follow a rotation of treated corn or soybeans, can pick up residues from these prior applications, sometimes at harmful levels. In some soils, repeated application of slow-to-degrade neonics can lead to accumulation over time, resulting in higher levels in the environment than the amount introduced through any one application.
Neonics are the most commonly used insecticides in the US and the most common type of insecticide applied as seed treatments for crops. Nearly all corn and over 60% of soybean crops are grown from neonic-treated seeds in the U.S. Here in Vermont, neonicotinoid seed coatings are **the largest single contributor to insecticide use** in the State of Vermont, even at the low-end estimate of their use (~1,480 lbs). In 2021, according to pesticide use reporting from the Agency of Ag, around 6,191 pounds of insecticides were applied in Vermont by certified commercial, non-commercial and government applicators, which means **the upper estimate for neonicotinoids applied by seed treatment (~7,410 lbs) is higher than all other insecticides applied in the state *combined*.**[6,7]

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[3] DiBartolomeis et al. (2019) https://doi.org/10.1371/journal.pone.0220029
[4] Douglas et al. (2020) https://doi.org/10.1038/s41598-019-57225-w
[5] Douglas & Tooker (2015) https://doi.org/10.1021/es506141g
[6] VT AAFM. 2021. Statewide Pesticide Usage Report. https://agriculture.vermont.gov/public-health-agricultural-resource-management-division/pesticide-programs/pesticide-usage-reported

Neonics applied as seed treatments contaminate soils in fields and field margins, flowering plants around fields, and the ditches, streams, rivers, and groundwater that receive these mobile, persistent chemicals. More than 90% of the active ingredient applied as seed coatings is not taken up by the target crop and instead moves elsewhere in the environment.[8] The levels of neonicotinoids found in wildflowers and soils resulting from seed treatments are ecologically relevant; even levels in nectar and pollen below 10 parts per billion (ppb) can cause harm to bee health and their ability to reproduce. Honey bees and bumble bees produce significantly fewer offspring when chronically exposed to trace amounts of neonics.

While there is only a small amount of research in Vermont on this issue at this point, the abundance of data from other places tells a story that indicates concern across landscapes. Bees encounter neonics as particulate matter in the air during planting, then later in pollen and nectar of plants in field margins, in puddles of water around fields, in dew droplets coming off of treated crops, and in soil. The dust created in the planting process poses a drift risk, especially during dry conditions. Field data and modeling from Indiana suggest that over 94% of honey bee foragers across the state are at risk from neonic dust off during planting.[9] The same research estimated that a pulse of neonicotinoid residues would be deposited on nearly half of the state's land area during corn planting.

This contamination has real world harm. Honey bee colonies exposed to neonics during corn planting have higher mortality and slower growth.[10] Importantly, it's not just honey bees at risk: research from eastern Ontario found that agricultural fields with higher levels of soil neonicotinoids had significantly lower wild bee abundance and diversity than those with low or no neonicotinoids detected.[11] Similar research in Missouri found fewer native bee species in field margins with higher concentrations of neonics in soil.[12] Our native, ground nesting bees are encountering these pesticides in soil and in the flowers they visit for food.

Pollinators are not the only species at risk from widespread, prophylactic use of these seed treatments. Neonics end up in water at levels that threaten aquatic life. Studies from the Midwest and Canada have found elevated pulses of neonicotinoids in waterways during crop planting, attributed to seed treatments.[13,14] Higher concentrations of neonicotinoids in water and sediment after the planting of treated seeds in Missouri floodplains were associated with a decrease in aquatic insect richness and abundance.[15] Over a third of Vermonters participate in fishing and over half birdwatch. When aquatic insects decline, the effects can be far reaching and ripple up the food chain: fish and birds rely on healthy populations of aquatic insects for their food.

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[7] VT AAFM. 2023. Neonicotinoid Use in Vermont. https://agriculture.vermont.gov/sites/agriculture/files/doc_library/2023_1211%20Vermont%20neonicotinoid%20use.pdf
[8] Wood & Goulson (2017) https://doi.org/10.1007/s11356-017-9240-x
[9] Krupke et al. (2017) https://doi.org/10.1111/1365-2664.12924
[10] Samson-Robert et al. (2017) https://doi.org/10.7717/peerj.3670
[11] Gaudreault et al. (2022). https://doi.org/10.1111/afe.12530
[12] Main et al. (2021). https://doi.org/10.1016/j.scitotenv.2021.147299
[13] Hladik et al. (2014) https://doi.org/10.1016/j.envpol.2014.06.033
[14] Berens et al. (2021) https://doi.org/10.1002/etc.4959
[15] Kuechle et al. (2022) https://doi.org/10.1007/s11356-022-18991-9

The exponential increase in neonic use, driven by corn seed treatments, is especially problematic because these treated seeds are planted year after year not in response to a pest threat, but as a preventive measure - even in fields with no history of pest pressure. The risks posed to our state's natural resources may be entirely unnecessary, given the lack of evidence that seed-applied neonicotinoids are addressing a specific, well-documented pest threat.

Agronomic research from our neighbors in Quebec indicates that neonicotinoid seed treatments are useful in less than 5% of fields.[16] This means that within Vermont, thousands of pounds of pesticides may be applied unnecessarily every year. It is very much worth highlighting that no crop failures have been documented in Quebec to date based on their 2019 restrictions on neonic treated seeds. And total use of seed with no insecticide treatment - meaning no neonics and no diamides - continues to grow annually in Quebec as farmers have seen the lack of need for it.[17]

It is the widespread prophylactic use of pesticide seed treatments that is so ecologically damaging. What's more, it goes against pretty basic agricultural and pesticide stewardship practices. We avoid overuse of antibiotics to avoid developing resistant strains of pathogenic bacteria. The same concept applies in agriculture: Use of the same chemistry over and over is bound to lead to resistance in the treated pests. We are already seeing resistance in insect pests, including in crops that are simply planted in landscapes with extensive treated seed usage.[18]

Ornamental and turf uses pose harm to pollinators in residential landscapes

I've talked about the way in which treated seeds introduce unnecessary risk into our environment. I also want to briefly talk about ornamental and turf uses. Residential landscapes can be important havens for pollinators, especially as more folks have begun incorporating pollinator plants around homes and towns.

Just as field margins with flowering plants can be contaminated by a crop field treated with neonicotinoids, the same is true in the residential environment. Pesticide applications can reduce the value of habitat for pollinators. Neonics are commonly used to kill grubs in lawn, and similar to treated seed use these applications are often made prophylactically without having identified a problem. In residential settings, many of these uses are made for cosmetic reasons, not to address an economic pest. Turf applications can move through the soil profile into groundwater and irrigation water. They do not stay put; neonics applied to lawns can move meters away laterally and into flowering plants, like in pollinator gardens planted next to a treated lawn. Application rates in yards can be much higher than in ag fields. Some products labeled for ornamental use on trees and shrubs are labeled for use at rates 12 to more than 100 times higher than an equivalent product labeled for agricultural use.[19]

Because of their high toxicity, it is easy for small errors in neonic applications to cause enormous harm. For example, in 2013, the largest native bee kill ever recorded occurred in Wilsonville, Oregon. More than 50,000 bumble bees died when 55 blooming linden trees in a Target parking

[16] Labrie et al. (2020) https://doi.org/10.1371/journal.pone.0229136
[17] Letter to Gov. Hochul from Louis Robert and Dr. Genevieve Labrie. August 7, 2023. Available: https://drive.google.com/file/d/1-XgopE5PJaFFuJyytRi9-F3FFEvRURpS/view
[18] Huseth et al. (2018) https://doi.org/10.1021/acs.est.7b06015
[19] Hopwood et al. (2016). How Neonicotinoids Can Kill Bees. https://xerces.org/publications/scientific-reports/how-neonicotinoids-can-kill-bees

lot were sprayed with a neonicotinoid by trained professional applicators. This loss represents potentially hundreds of wild bumble bee colonies. While this incident was obvious, smaller bee kills can easily go unnoticed, especially when poisonings occur in agricultural fields or natural areas.

Importantly, the Wilsonville bee kill, along with seven other reported bee kills in Oregon in 2013 and 2014, were due to applications of neonicotinoid pesticides by licensed pesticide applicators. Some of the mass bee deaths occurred months after neonic applications were made. Injecting neonics directly into woody plants or via soil drenches mean the chemicals are largely protected from UV breakdown and are therefore highly persistent, so an application made to a pollinator-attractive tree in the fall can result in harmful levels in nectar and pollen in the spring.[20] Rhododendron flowers contained lethal levels of imidacloprid six months after being treated by soil drench at label rates.[21] I will remind you that it's not just obvious flowering trees that attract pollinators: bees are visiting ash, oaks, maples, beech, and other less obvious (and even wind pollinated) woody species for pollen or nectar. Making neonicotinoids restricted use was a good first step towards reducing unintended harm by untrained applicators, but most of the Oregon bee kills were licensed applicators following label directions. The margin for error is very small with these highly toxic pesticides and the labels are not always protective enough.

We know enough to act now

We recognize that there is uncertainty about pest incidence across the state, and that additional research will be useful to help figure out how best to monitor and predict pest damage in order to decide where and when coated seeds may be a useful tool. However, we do not believe that this is reason enough not to act to reduce known harm from neonic-coated seeds. Every year that action is delayed, the continued widespread use of these seeds results in additional harm to pollinators, soil life, and aquatic life.

Best management practices for insecticide coated seeds should reduce potential harm by moving farmers towards more sustainable, economically justified pest management practices (i.e., surveillance and monitoring to establish a field history of pest incidence prior to use of treated seeds - Xerces developed a decision guide for Iowa that provides an example framework for how scouting and past field records can provide justification for use of seed treatments the following year. It can be done.) We know enough to act now. Given the evidence of ecological harm caused by overuse of neonics, it was disappointing to see the Agricultural Innovation Board produce not just weak recommendations, but functionally no recommendations at all for growers on use of treated seeds.

We have also heard about the constraints of the seed market, and the lack of availability of untreated seeds. I do not think that state policy needs to be constrained by perception of existing market forces. As we saw in Quebec, and as you heard from the trade representatives last week, the market will respond to demand, and policy interventions can shape that demand. New York is a much larger market for seeds than Vermont, and we will likely see greater access to alternative

[20] Mach et al. (2017) https://doi.org/10.1002/etc.4021
[21] Doering et al. (2004). Residues of imidacloprid WG 5 in blossom samples of Rhododendron sp. after soil treatment in the field. Application autumn 2003, sampling 2004. Bayer CropScience AG. Report 2004b; No. G201820.

seeds opening up in response to the legislation they passed phasing out treated seeds in several crops.

In conclusion:

- Neonicotinoid insecticides are highly toxic at very small doses to bees, other insects, and birds.
- They are used widely with no evidence of pest pressure or damage.
- They are the largest contributor to insecticide use in the state.
- The harms are evident and we know enough to act now.

Across the country, state and local governments are taking action to limit the harms from neonicotinoids. With H.706, Vermont has the opportunity to address the largest sources of these highly toxic insecticides and the risks they are posing to our pollinators, birds, and aquatic life.

Thank you for this opportunity to testify in support of H.706.

Sincerely,

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