Testimony concerning H.706 - An act relating to banning the use of neonicotinoid pesticides on February 9, 2024 for the Vermont House Committee on Agriculture, Food Resiliency, and Forestry from Kent McFarland, Vermont Center for Ecostudies - Vermont Atlas of Life

Chairman Durfee and distinguished members of the Vermont State Agriculture, Food Resiliency & Forestry Committee, thank you for inviting the Vermont Center for Ecostudies to testify on H.706, a bill requiring restrictions on neonicotinoids.

I am the director of the Vermont Atlas of Life at the Vermont Center for Ecostudies. I have been studying wildlife in Vermont and beyond for over 30 years. I have been a member of the State Advisory Group for Invertebrates to the Endangered Species Committee since 2002 and the chair for over a decade. And I was involved in both the 2005, 2015, and the upcoming 2025 Vermont Wildlife Action Plans by the Vermont Fish & Wildlife Department.

I was one of the principal investigators for the Vermont Bumble Bee Atlas project and co-authored recommendation reports submitted from the State Advisory Group for Invertebrates to the Vermont Endangered Species Committee for four bumble bee species, of which all are now listed as Threatened and Endangered in Vermont. One is now listed Federally (Rusty-patched Bumble Bee, and another is under review (American Bumble Bee), with the 90-day review by USFWS finding in 2021 that it may warrant listing.

In the late 1990s and early 2000s, there were many reports from around the world concerning the decline of bumble bees. Here in Vermont, there was little data beyond anecdotal evidence to assess bumble bee populations. With the help of the Vermont Fish & Wildlife Department and other partners, the Vermont Atlas of Life conducted a statewide survey from 2012 through 2014 (https://val.vtecostudies.org/projects/bumble-bee-atlas). By comparing our surveys with historic collections at the UVM Natural History Museum and others, we found significant declines in bumble bee diversity and abundance in Vermont (Richardson et al. 2019). Seventeen bumble bee species were documented as native to the state and we documented the possible extirpation (local extinction) in Vermont of three species in the late 1990s and significant declines among four others. These population trends have led to a homogenization of the bumble bee community.

Based on the conclusions of this study, the state of Vermont listed four bumble bees as Threatened or Endangered, including Ashton cuckoo bumble bee, yellow-belted bumble

bee, American bumble bee and the rusty-patched bumble bee. The latter was also listed as federally endangered by the US Fish and Wildlife Service in 2017. Further, nine bumble bee species were listed as Species of Greatest Conservation Need in the 2015 Vermont Wildlife Action Plan.

Declines in bumble bee abundance, diversity, and range extent have been attributed to numerous factors, in particular (1) parasite and disease exposure, especially following contact with managed bees (both honey and bumble bees); (2) pesticides; (3) habitat loss; and (4) climate change. And of course, it is likely that multiple stressors occur simultaneously. To quote Dr. David Wagner, distinguished University of Connecticut entomologist, “Insects are suffering from death by a thousand cuts” (Wagner et al. 2021).

For example, in the case of the Federal- and State-Endangered Rusty-patched bumble bee, the USFWS states that the cause of the species’ drastic decline is unknown, but evidence suggests a harmful interaction between a disease-causing pathogen and exposure to pesticides. Other threats to the insect include habitat loss and degradation, competition and disease introduction from managed (both honey and bumble bees) and non-native bees, small population genetics, and climate change.

Bumble bees may be threatened by exposure to pesticides when residues occur in pollen and nectar of their food plants. Of principal concern are insecticides applied to control insect herbivores, including topically applied compounds such as carbamates and organophosphates, as well as compounds applied belowground that are systemic within plants, such as neonicotinoids. Certain fungicides and herbicides are also toxic to bees. And, there is evidence for synergistic negative impacts of pesticide combinations on bees. This is a concern because bees are commonly exposed to residues of many pesticides simultaneously.

A very large body of peer-reviewed research shows detrimental effects of neonicotinoids on bees and other pollinators (e.g. see Wood and Gaulson 2017 and studies therein). Sublethal effects from feeding on pollen and nectar include: lower reproduction rates, reduced navigation abilities, poor foraging behavior, less successful pollination, and reduced immune function. All of these sublethal effects can lead to colony size reduction or failure for social bees or diminished reproduction for solitary bee species.

Neonicotinoids can be sprayed onto foliage, applied as soil drenches, or as seed treatments before planting. Neonicotinoids are taken up by all parts of the plant as it grows. This means these systemic insecticides are present in pollen and nectar that

pollinators can come in contact with when foraging. In addition, neonicotinoids have been found in nearby, non-target environments such as natural areas, interstitial areas with wildflowers, waterways, and they can persist in the soil.

In August 2021, the EPA released draft biological evaluations for three neonicotinoids to determine whether they may affect one or more species listed under the Endangered Species Act (ESA) or their designated critical habitats. The EPA must register all pesticides before they can be sold and used, and this registration triggers the requirement to engage in consultation under the ESA. These neonicotinoids were found “likely to adversely affect” many of the Endangered and Threatened terrestrial invertebrate species, including pollinators such as Rusty-patched bumble bee.

However, under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), seeds coated with chemicals are considered “treated articles" rather than pesticides. The use of pesticides in this manner is not tracked. But some estimates suggest that in Vermont >90% of corn seed (85,000 acres in 2021) and >40% of soybean seed (4,800 acres in 2017) is treated with neonicotinoid pesticide (Richardson et al. 2018, Griffith 2022).

Pollination services provided by native insects, mostly bees, are estimated at $3 billion per year in the United States. For some crops, native bumble bees pollinate more effectively than non-native honey bees, in part because they fly in cooler temperatures and lower light levels. But also, bumble bees are “buzz” pollinators. The bee grabs the flower stamen and vibrates her wing muscles causing pollen to fall. This is highly effective for the cross-pollination of tomatoes, peppers, cranberries, and blueberries.

For example, a 2019 UVM study found that of the nine berry farms studied across Vermont, wild bees could boost production up to 36%, or roughly $136,000 per year, on one mid-sized berry farm alone (Nicholson & Ricketts 2019). And, nearly all of the pollination service documented in this study was delivered by unmanaged, wild bees, in particular three species of bumble bees and two species of ground-nesting solitary bees (Andrena), along with about 90 other species of native bees.

A 2016 study, by UVM and others (Koh et al. 2016), estimated that wild bee abundance declined in 23% of the contiguous U.S. from 2008 and 2013. It also showed that 39% of U.S. croplands that depend on pollinators—from apple orchards to pumpkin patches — face a threatening mismatch between rising demand for pollination and a falling supply of wild bees.

How many wild bee species are there in Vermont and what is their status? To begin to answer this, we conducted a wild bee survey in Vermont from 2019 to 2023, in

cooperation with the Vermont Fish & Wildlife Department, UVM and others (Hardy et al. 2022). We scoured museum collections for past specimens and surveyed bees across the state with the help of thousands of volunteers. We transformed historic museum collections and all of our modern surveys into digital datasets that are open and freely available online from the Vermont Atlas of Life.

We documented 356 wild bee species in the state by gathering over 77,000 records, including historic specimens. Remarkably, since beginning the project in 2019, we've documented 70 new species for Vermont, highlighting the lack of previous statewide study. Despite our collective efforts, we still lack robust population monitoring and key natural history information for most bee species in the state. Estimating population trends requires a time-series of abundance estimates. Only about 4,500 bee records in Vermont were documented before 2000, and nearly half of these observations represent just 16 species of bumble bees. There is remarkably few historic data for which to understand population changes in Vermont for the bulk of species.

Vermont is one of the few states that has a relatively complete assessment of its current wild bee fauna. A critical step in setting priorities for biodiversity conservation is an assessment of extinction risk. This requires detailed knowledge of the distribution, population size and trends, and critical threats for each species. The NatureServe Conservation Rank Calculator, used by the Vermont Fish & Wildlife Department for state ranks, enables conservation biologists to translate this knowledge into three categories of information: rarity, threats and trends. The tool uses these data to determine an overall conservation status rank by automatically applying specific rules. These results are then reviewed by experts and in some cases adjusted based on further information.

We assigned preliminary state conservation ranks (S-ranks) to 335 native bee species in Vermont. Ten species that had no records after the year 2000 were assigned an SH (Historical) or SX (extirpated). Over 30% of Vermont's extant native bee species are preliminarily ranked as critically imperiled or imperiled. Many critically imperiled species are known from just a few records, often from a single location, and with no direct information about population trends. Many of these species may be naturally rare in Vermont, making their populations susceptible to environmental perturbations. On the opposite spectrum, nearly 23% of native bee species are apparently secure or secure.

Using Species of Greatest Conservation Need criteria from the 2015 Vermont Wildlife Action Plan, we identified 55 bee species that we believe are in urgent need of conservation efforts and should be considered for SGCN status when the State Wildlife Action Plan is updated in 2025. Additionally, our knowledge of Vermont bees was incorporated into the Northeast Association of Fish & Wildlife Agencies recent update to

the list of Regional Species of Greatest Conservation Need. The list now includes 19 bee species that have been recorded in Vermont.

Bee communities are the assemblages of species that occur together in a given location. Using occurrence data for 235 native bee species, we created species distribution models that allowed us to compare bee communities across Vermont at the scale of one square kilometer. Using these data we were able to identify areas within the state that support unique bee communities. Identifying these areas within Vermont is critical to maintain bee diversity into the future. Many of these areas warrant further investigation, but conservation action should be a priority. Many areas that harbor unique bee communities and high bee diversity occur in regions that are also conducive for corn and soybean acreage (see figure 1 below). Treated crops in these areas expose these unique bee communities, which are critical to sustaining biodiversity in Vermont, to neonicotinoids (Hardy et al. 2022, USDA 2024).

Population losses of native bees could have far-ranging ecological and economic impacts due to their keystone roles as pollinators. Over 20,000 observation records in Vermont of bee-plant interactions revealed that 225 bee species visited at least 438 different plant species in 92 families. Many bee species are specialists and only feed their offspring pollen from a single genus or species of plant. Even specialists will occasionally visit other flowers to feed on nectar. On the other hand, generalists use pollen from an assortment of unrelated plant species. For example, the Common Eastern Bumble Bee has been associated with 159 different plant genera in Vermont. Half of the Vermont wild bee species have been recorded visiting plants we eat.

Neonicotinoid pesticides may also harm other pollinators such as butterflies. Researchers examined 40 years of butterfly monitoring data in northern California and found a negative association between butterfly populations and increasing neonicotinoid application was detectable while controlling for land use and other factors (Forister et al. 2016). Smaller butterfly species that produced fewer generations each year were the most affected. These declines were associated with increasing use of neonics across the region, beginning in the mid-1990s. In Vermont, we have no population monitoring data available for butterflies. However, we conducted the first Vermont Butterfly Atlas from 2002-2007 and two decades later, we are now conducting the second atlas (2023-2027). Combined, these statewide Atlases may shed light on possible changes in Vermont butterfly ranges and populations across the state during the last 20 years.

In summary, wild bees and other native pollinators that provide critical ecosystem services are essential for Vermont agriculture and our natural ecosystems. Some bumble bees in Vermont have had a marked decline in the last 30 years, likely due to

multiple stressors. One of these stressors is pesticides. Neonicotinoids are known to cause both lethal and sublethal harm to wild bees and other pollinators. Addressing the use of this stressor on pollinator populations and other insects is an important step for their conservation. Population losses of some of these native bees and other insects could have far-ranging ecological and economic impacts due to their keystone roles as pollinators.

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Figure 1. Many areas that harbor high bee diversity (A) or unique bee communities (B; dark gray) occur in regions that are also conducive for corn and soybean farming (left maps). Green blocks are areas that were planted in corn or soybean any year since 2008 (USDA 2024). The inset portion of both shows a closer view of the areas with intensive corn and agriculture and bee diversity or regions that support unique bee communities.