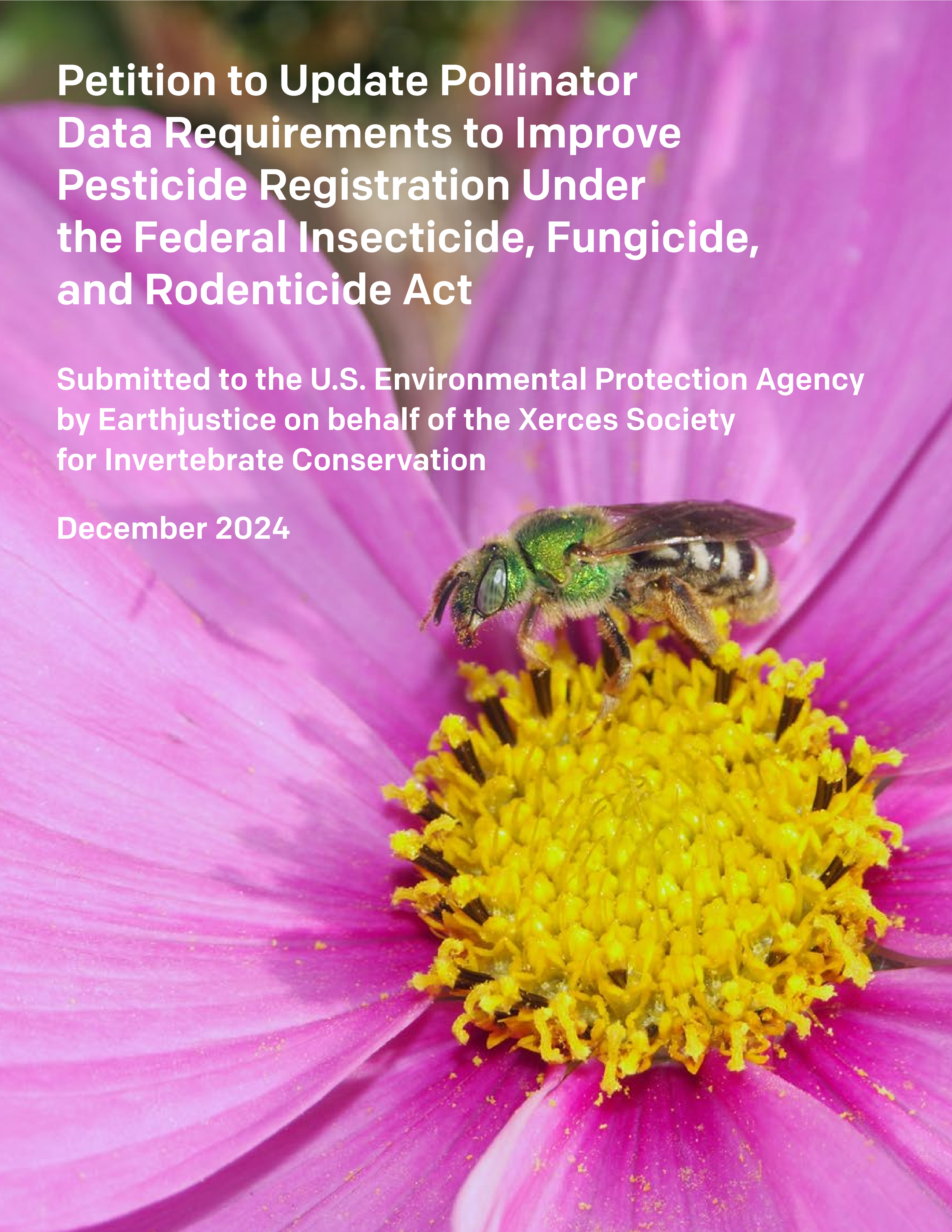

Petition to Update Pollinator Data Requirements to Improve Pesticide Registration Under the Federal Insecticide, Fungicide, and Rodenticide Act

Submitted to the U.S. Environmental Protection Agency
by Earthjustice on behalf of the Xerces Society
for Invertebrate Conservation

December 2024

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On cover: Green sweat bee (*Agapostemon virescens*)
by Mace Vaughan for the Xerces Society for Invertebrate Conservation

INTRODUCTION AND SUMMARY

In her ground-breaking book *Silent Spring*, Rachel Carson offered "A Fable for Tomorrow" in which she warned of the dangers of unchecked pesticide use. She spoke of a world where "[t]he apple trees were coming into bloom but no bees droned among the blossoms, so there was no pollination and there would be no fruit."[1] The roadside flower gardens too, "once so attractive . . . were silent, deserted by all living things."[2] "[N]o enemy action had silenced the rebirth of new life in this stricken world," Carson warned. "The people had done it themselves."[3]

Six decades have passed since *Silent Spring* was published but Carson's "fable for tomorrow" remains an apt warning for the present day. A global meta-analysis of long-term monitoring data found that hundreds of insect species have declined in abundance by an average of forty-five percent since 1970.[4] These insects provide a host of essential ecosystem services, such as water purification, decomposition, biological control of pests and disease vectors, and pollination. Insect pollinators, in particular, have proven to be an especially vulnerable group. The United Nations Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services found that many countries face losses of more than forty percent of their bee and butterfly species in the coming decades.[5]

Yet the majority of the world's plants require insect pollination, provided by a diverse assemblage of bees, butterflies, moths, flies, and beetles. These plants, in turn, serve as the foundation for terrestrial food webs. Insect pollinators are also critical to human food security. Although many industrial-scale crops are dependent upon managed honey bees for pollination, wild bees, butterflies, moths, and flies play a significant and often overlooked role in crop pollination as well. And such insects pollinate wild plants throughout the globe. It is thus clear that the protection of diverse and wild insect pollinators is paramount to the survival of human and non-human life alike. But many of these species are in sharp decline.

Widespread pesticide use is a major driver behind the global decline of insects, including insect pollinators. Today's agricultural landscape is dominated by the use of "systemic" insecticides, such as neonicotinoids and related compounds, which are absorbed into plant tissues and thus subject invertebrate pollinators to exposure pathways—via pollen, nectar, and other plant parts—that they do not face with non-systemics. Additionally, many of the most common insecticides used today are much more toxic to insects than their older pesticide counterparts and persist significantly longer in the environment. In theory, the heightened efficacy of modern-day pesticides against invertebrate pests should mean pesticides are applied at lower rates. Yet pesticide usage rates have not meaningfully declined since less insect-toxic pesticides dominated the market. Moreover, today a large volume of pesticide use in the United States is preemptive—that is, agricultural landscapes routinely receive pesticide treatments at levels damaging to many taxa even before there is a demonstrated pest problem.

The publication of *Silent Spring* marked a watershed moment that prompted a widespread reckoning of the toll that human activities, including chemical overuse, could take on our

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[1] Rachel Carson, *Silent Spring* 2–3 (1962).

[2] *Id.* at 3.

[3] *Id.*

[4] *See* Rodolfo Dirzo et al., *Defaunation in the Anthropocene*, 345 Science 401, 402 (2014).

[5] Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), The Assessment Report on Pollinators, Pollination and Food Production XXXV (2017) [hereinafter "IPBES Pollinator Report"].

environment. In response, reforms were enacted, including the establishment of the U.S. Environmental Protection Agency (EPA). Indeed, EPA's own recounting of its origin story acknowledges that "EPA today may be said without exaggeration to be the extended shadow of Rachel Carson."[6]

Today, however, EPA is falling short of its visionary mission to ward off the desolate future that Carson foresaw. In particular, EPA is failing its obligation under our nation's pesticide law, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), to prevent unreasonable adverse effects from the intensive, widespread use of modern-day pesticides, which are causing harm to critically important insect pollinator populations. As is so often the case in evaluating such regulatory failures, the devil is in the details. The linchpin of EPA's pesticide evaluation program is a risk assessment informed by data from private entities who must apply to EPA for registrations that enable them to lawfully distribute their products.

While EPA requires such pesticide registrants to submit testing data concerning the impacts of a given pesticide on insect pollinators, these data are exceedingly limited and are increasingly inadequate to illuminate the full range of serious injuries that pesticides may inflict on insect pollinators. EPA requires registrants to submit data addressing pesticide impacts on only honey bees and treats honey bees as a surrogate for all pollinating insects, yet there is wide variability in pesticide vulnerability across the thousands of pollinating insect taxa that renders honey bees an inadequate representative for all insect pollinators. Even where EPA requests more pesticide testing data of registrants on a case-by-case basis, EPA's failure to codify data requirements results in uneven regulation, delayed mitigations, and critical data gaps. And while EPA has languished for nearly two decades with an inadequate set of regulatory requirements to assess pesticide risks for the United States, rapidly advancing scientific tools are pointing the way toward a more thorough approach that overseas regulators are embracing to prevent serious pesticide harms in their countries while facilitating agricultural production. In sum, EPA's pollinator testing requirements are so limited as to severely underestimate the threats pesticides pose to insect pollinators of all stripes and fail to reflect modern scientific advances.

This petition calls upon EPA to renew its leadership role in safeguarding our environment by updating the data requirements central to its pollinator risk assessment. Specifically, on behalf of the Xerces Society for Invertebrate Conservation, we request that EPA amend its FIFRA pollinator data requirements at 40 C.F.R. Part 158 in the manner set forth in the discussion below. To fulfill its role as guardian of the public interest against the unreasonable adverse effects of pesticides, EPA must require pesticide registrants to submit more data on the impacts of pesticides on insect pollinators and thus bring its pollinator risk assessment into alignment with current scientific research and international risk assessment standards. Until that happens, EPA's pollinator risk assessment will continue to significantly underestimate the toll of pesticides on insect pollinators essential to the web of life, and thereby threaten our nation's environment with continued degradation toward the "stricken world" of Rachel Carson's admonition. With pollinator populations at unprecedented lows, the time to act is now.

PETITIONER

The Xerces Society for Invertebrate Conservation (Xerces) is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. Xerces has been at the forefront of invertebrate protection worldwide for over a half century, harnessing the

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[6] Jack Lewis, *The Birth of EPA* (1985), https://www.epa.gov/archive/epa/aboutepa/birth-epa.html.

knowledge of scientists and land managers and the enthusiasm of local community members to implement conservation programs. Xerces works to raise awareness about the plight of invertebrates and to gain protection for the most vulnerable species before they decline to a level at which recovery is impossible. Wild pollinator conservation, including advocacy against the overuse of ecologically harmful pesticides, has been a core component of Xerces' work for decades. Most recently, Xerces has authored research papers documenting the threats posed to wild pollinators by neonicotinoid insecticides, submitted petitions to list endangered and threatened wild pollinators species under the Endangered Species Act, and commented on EPA draft strategies to mitigate the adverse impact of pesticides on vulnerable species, among other initiatives.

ACTIONS REQUESTED

This petition asks EPA to initiate a rulemaking to amend 40 C.F.R. Part 158, including the "Terrestrial and Aquatic Nontarget Organism Data Requirements" table at 40 C.F.R. § 158.630, by: (1) codifying mandatory testing of acute oral toxicity to adult honey bees, acute oral toxicity to larval honey bees, chronic oral toxicity to adult honey bees, and chronic oral toxicity to larval honey bees; (2) codifying mandatory testing of pesticide impacts on bumble bees and solitary bees; and (3) codifying mandatory testing of pesticide impacts on butterflies and moths. We submit this petition on Xerces' behalf pursuant to its right to petition the government under the Administrative Procedure Act, 5 U.S.C. § 551, and the First Amendment to the U.S. Constitution.

STATEMENT OF FACTUAL AND LEGAL GROUNDS

I. Recent years have seen massive pesticide use and corresponding pollinator declines.

Our nation today receives intensive application of increasingly insect-lethal and pervasive pesticides, even as our agricultural production is threatened and our national heritage of biological diversity is impoverished by the mounting loss of insect pollinators. Roughly one billion pounds of conventional pesticides are applied in the United States each year.[7] The United States is second only to China in overall volume of pesticide usage worldwide.[8] EPA has approved over 500 pesticide active ingredients for use in agriculture—including insecticides, herbicides, and fungicides—since its formation in 1970.[9] Most of those pesticides are still in use today.[10]

Over the last several decades, pesticide usage has shifted toward chemicals that are considerably more toxic to insects than their older counterparts.[11] This contributes to what

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[7] Ohio-Kentucky-Indiana Water Science Center, U.S Geological Survey, *Pesticides* (Mar. 23, 2017), https://www.usgs.gov/centers/ohio-kentucky-indiana-water-science-center/science/pesticides.

[8] Nathan Donley, *The USA Lags Behind Other Agricultural Nations in Banning Harmful Pesticides*, 18 Environmental Health 1 (2019).

[9] *Id.* at 3.

[10] *Id.* at 4–5.

[11] Margaret R. Douglas et al., *County-Level Analysis Reveals a Rapidly Shifting Landscape of Insecticide Hazard to Honey Bees* (Apis mellifera) *on US Farmland*, 10 Scientific Reports 1, 3 (2020); Michael

researchers have called a "potency paradox": while overall pesticide usage by weight in the United States has declined slightly since the early 1980s, the pesticides currently in use are significantly more hazardous to insects and persist longer in the environment than older pesticides.[12] Newer generations of highly insect-toxic pesticides include pyrethroids, a class of synthetic, neurotoxic insecticides;[13] insect growth regulators, which target insect reproduction and development;[14] and, perhaps most significantly, newer classes of systemic insecticides, such as anthranilic diamides, phenylpyrazoles, sulfoximines, and neonicotinoids.

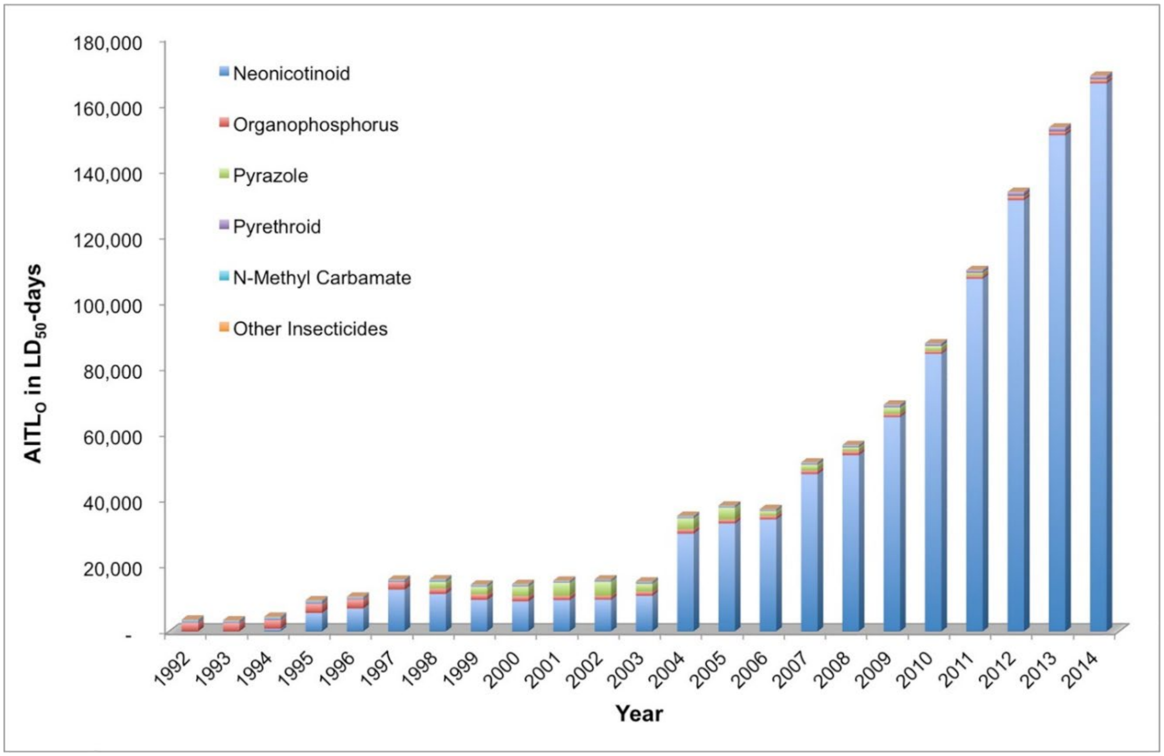

Figure 1: Oral acute insecticide toxicity loading (AITL_O) by chemical class, 1992–2014. The AITL_O represents the total mass of insecticides used in the United States, the acute oral toxicity to honey bees, and the environmental persistence of the pesticides. AITL_O increased 48-fold over this time period, primarily attributable to neonicotinoids.[15]

DiBartolomeis et al., *An Assessment of Acute Insecticide Toxicity Loading (AITL) of Chemical Pesticides Used on Agricultural Land in the United States*, 14 PLoS ONE 1 (2019).

[12] Douglas et al., *supra* note 11, at 3; DiBartolomeis et al., *supra* note 11, at 1; Ralf Schulz et al., *Applied Pesticide Toxicity Shifts Toward Plants and Invertebrates, Even in GM Crops*, 372 Science 81 (2021); *see also* U.S. Dep't of Agriculture, Economic Research Service, *Pesticide Composition and Use has Changed Over Past Five Decades*, https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=77462 (last visited Oct. 2, 2024) (noting that decrease in volume of pesticide use since 1980 is also explained by the fact that "over 90 percent of corn, cotton, and soybean acres were treated with herbicides" since that time, "leaving little room for increased use").

[13] Óscar López & José G. Fernández-Bolaños, eds., *Green Trends in Insect Control* 95, 101 (2011).

[14] Julia D. Fine, *Evaluation and Comparison of the Effects of Three Insect Growth Regulators on Honey Bee Queen Oviposition and Egg Eclosion*, 205 Ecotoxicology and Environmental Safety 1 (2020).

[15] DiBartolomeis et al., *supra* note 11, at 10–11, 12 fig. 5. Oral exposures are of "potentially greater concern" than contact exposures "because of the relatively higher toxicity . . . and greater likelihood of exposure from residues in pollen nectar, guttation water, and other environmental media." *Id.* at 1.

Since their introduction in the 1990s, neonicotinoid insecticides have become the most widely used class of insecticides in the world, supplementing and sometimes displacing older generations of pesticides such as organophosphates and carbamates.[16] EPA estimates that over 3.5 million pounds of neonicotinoids were applied to nearly 127 million acres of agricultural crops annually from 2009 to 2011.[17] Named for their chemical similarity to nicotine, neonicotinoids disrupt an insect's central nervous system, causing it to become paralyzed and ultimately die.[18] Whereas older classes of pesticides are commonly applied to plants topically via spray or other applications, "systemic" pesticides like neonicotinoids are taken up by a plant's roots or leaves and distributed to all parts of the plant, regardless of mode of application.[19] This renders the entire plant—including new growth not even in existence at the time of pesticide application—toxic to target insects.[20] Neonicotinoids in particular are so ubiquitous that they have "transformed the agrochemical landscape to one in which most flowering crops and an unknown proportion of wild flowers contain varying concentrations of neonicotinoids in their pollen and nectar" at any given time.[21]

Many systemic insecticides are applied prophylactically—that is, before there is a demonstrated pest problem—via treated seeds. Seed treatment refers to the application of insecticide to crop seeds prior to planting. It is the most common application method for the top three most-used neonicotinoids applied in the United States: over 98 percent of clothianidin is applied via seed treatment;[22] about 86 percent of thiamethoxam;[23] and 56 percent of imidacloprid.[24] Researchers point out that this preemptive insecticide use is inconsistent with Integrated Pest Management (IPM) principles, which privilege the "manage[ment] [of] pest damage by the most economical means, and with the least possible hazard to people, property, and the environment."[25] There are only two instances in which preemptive insecticide use is

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[16] Margaret R. Douglas & John F. Tooker, *Large-Scale Deployment of Seed Treatments has Driven Rapid Increase in Use of Neonicotinoid Insecticides and Preemptive Pest Management in U.S. Field Crops*, 49 Envtl. Sci. & Tech. 5088, 5092–93 (2015).

[17] Memorandum from David Brassard, Biological and Economic Analysis Division, Office of Chemical Safety and Pollution Prevention, U.S. EPA, to Marianne Lewis, Registration Division, Office of Pesticide Programs, U.S. EPA (Aug. 30, 2012). Researchers warn that these and other estimates are likely low, as they do not include treated seed uses. *See* Douglas & Tooker, *supra* note 16, at 5089–94.

[18] *See* Kazuhiko Matsuda et al., *Neonicotinoids: Insecticides Acting on Insect Nicotinic Acetylcholine Receptors*, 22 Trends in Pharmacological Sciences 573 (2001); Cynthia R. O. Jacob et al., *Oral Acute Toxicity and Impact of Neonicotinoids on* Apis mellifera L. *and* Scaptotrigona postica Latreille (Hymenoptera: Apidae), 28 Ecotoxicology 745 (2019).

[19] Noa Simon-Delso et al., *Systemic Insecticides (Neonicotinoids and Fipronil): Trends, Uses, Mode of Action and Metabolites*, 22 Environ. Sci. Pollut. Res. 6, 6–7 (2015).

[20] *Id.* at 7.

[21] Jeroen P. van der Sluijs et al., *Neonicotinoids, Bee Disorders and the Sustainability of Pollinator Services*, 5 Current Opinion in Environmental Sustainability 293, 299 (2013).

[22] U.S. EPA, *Clothianidin: Drinking Water Exposure Assessment for Registration Review of All Registered Uses* 33 (2017).

[23] U.S. EPA, *Preliminary Risk Assessment to Support the Registration Review of Thiamethoxam* 24–25 (2017).

[24] U.S. EPA, *Preliminary Terrestrial Risk Assessment to Support the Registration Review of Imidacloprid* 18 (2017).

[25] U.S. EPA, *Integrated Pest Management (IPM) Principles* (Sept. 3, 2024), https://www.epa.gov/safepestcontrol/integrated-pest-management-ipm-principles.

consistent with IPM: one, where rescue treatments cannot keep pests under the "economic injury level"; or two, where target pests are very likely to cause economic damage.[26] Neither of those conditions is likely satisfied for the majority of neonicotinoid usage in the United States.[27]

Such widespread pesticide use is ecologically significant in part because neonicotinoids and other systemic insecticides persist in the environment long after they are applied. Systemics are highly water soluble by design—this feature allows them to be taken up by the vascular system of plants—which means they easily end up in waterbodies around application sites.[28] Further, only 1 to 10 percent of neonicotinoids applied as seed treatments are actually taken up by the treated plant; the rest ends up in soil where it is "vulnerable to leaching."[29] Neonicotinoids are detected in soils and waterways months—even years—following application.[30] Researchers have observed similar trends in other systemic insecticides such as sulfoxaflor,[31] fipronil,[32] and diamides including chlorantraniliprole.[33] And the impacts of such insecticide persistence in the environment appear to be cumulative. Across the country, different insecticides are applied to the same landscapes over time; for example, water and soil samples from agricultural areas frequently detect multiple neonicotinoids at once.[34]

In 2014, the Worldwide Integrated Assessment on Systemic Pesticides examined over 800 peer-reviewed studies in an effort "to understand the diverse ramifications of the global use of systemic pesticides on individual organisms, on ecosystems and on ecosystem processes and services."[35] Their conclusion was unambiguous and sobering:

> Overall, a compelling body of evidence has accumulated that clearly demonstrates that the wide-scale use of these persistent, water-soluble chemicals is having widespread, chronic impacts upon global biodiversity and is likely to be having major negative effects on ecosystem services such as pollination that are vital to food security and sustainable development.[36]

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[26] *See* Douglas & Tooker, *supra* note 16, at 5094; *see also* John F. Tooker et al., *Neonicotinoid Seed Treatments: Limitations and Compatibility with Integrated Pest Management*, Agricultural & Environmental Letters 1, 2 (2017).

[27] *See* Douglas & Tooker, *supra* note 16, at 5094; *see also* Tooker et al., *supra* note 26, at 2.

[28] Simon-Delso et al., *supra* note 19.

[29] Tooker et al., *supra* note 26, at 4.

[30] Ola Lundin et al., *Neonicotinoid Insecticides and Their Impacts on Bees: A Systematic Review of Research Approaches and Identification of Knowledge Gaps*, 10 PLoS ONE 1, 2 (2015).

[31] *See, e.g.*, Sara Jiménez-Jiménez et al., *Stereoselective Separation of Sulfoxaflor by Electrokinetic Chromatography and Applications to Stability and Ecotoxicological Studies*, 1654 J. of Chromatography 1 (2021).

[32] *See, e.g.*, Janet L. Miller et al., *Common Insecticide Disrupts Aquatic Communities: A Mesocosm-to-Field Ecological Risk Assessment of Fipronil and its Degradates in U.S. Streams*, 6 Sci. Adv. 1 (2020).

[33] *See, e.g.*, Feng Cui et al., *Effects of Three Diamides (Chlorantraniliprole, Cyantraniliprole and Flubendiamide) on Life History, Embryonic Development and Oxidative Stress Biomarkers of Daphnia magna*, 169 Chemosphere 1 (2017).

[34] Michelle L. Hladik et al., *Environmental Risks and Challenges Associated with Neonicotinoid Insecticides*, 52 Env't Sci. Tech. 3329, 3330 (2018).

[35] Maarten Bijleveld van Lexmond et al., *Worldwide Integrated Assessment on Systemic Pesticides*, 22 Environ. Sci. Pollut. Res. 1, 2 (2015).

[36] *Id.* at 3; *see also* J.P. van der Sluijs, *Conclusions of the Worldwide Integrated Assessment on the Risks of Neonicotinoids and Fipronil to Biodiversity and Ecosystem Functioning*, 22 Environ. Sci. Pollut. Res.

Yet a decade later, these systemic pesticides remain registered for widespread use in the United States.[37]

These systemic and other pesticides are a major driver of sharp declines in pollinator populations. Researchers estimate that populations of hundreds of insect taxa—including many insect pollinators—shrunk 45 percent between 1970 and 2010.[38] In the last several decades, scientists have documented declines—and even local and global extinctions—of native bees such as bumble bees,[39] flies,[40] butterflies,[41] and moths.[42] Such losses manifest in a common human experience: the road trip formerly characterized by a car windshield covered by splattered insects increasingly features a windshield bearing little or no evidence of insect life.[43] Scientists studying these losses point to the new generation of highly insect-toxic pesticides as one of the main culprits behind this trend.[44]

In the United States, pesticides are also a significant causal factor behind the listings of a number of insect pollinators as threatened or endangered under the Endangered Species Act (ESA).[45] The rusty-patched bumble bee (*Bombus affinis*), listed as endangered in 2017, used to occur widely across the grassland and tallgrass prairies of the Upper Midwest and Northeast, but populations have declined an estimated 88 percent in the last several decades.[46] Like other bumble bees, the rusty-patched are among the most important pollinators of blueberries,

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148, 153 (2015) ("The combination of prophylactic use, persistence, mobility, systemic properties and chronic toxicity [of neonicotinoids and fipronil] is predicted to result in substantial impacts on biodiversity and ecosystem functioning.").

[37] Donley, *supra* note 8, at 1.

[38] *See* Dirzo et al., *supra* note 4, at 402.

[39] IPBES Pollinator Report at 159–61.

[40] *Id.* at 161–62.

[41] *Id.* at 162–63.

[42] *Id.* at 163.

[43] *See* Anders Pape Møller, *Parallel Declines in Abundance of Insects and Insectivorous Birds Iin Denmark Over 22 Years*, 9 Ecology and Evolution, 6581 (2019); Lawrence Ball et al., *The Bugs Matter Citizen Science Survey of Insect Abundance*, Kent Wildlife Trust (2022).

[44] *See* Laura Melissa Guzman et al., *Impact of Pesticide Use on Wild Bee Distributions Across the United States*, 7 Nature Sustainability 1 (2024); Francisco Sánchez-Bayo & Kris A.G. Wyckhuys, *Worldwide Decline of the Entomofauna: A Review of its Drivers*, 232 Biological Conservation 8 (2019); William M. Janousek et al., *Recent and Future Declines of a Historically Widespread Pollinator Linked to Climate, Land Cover, and Pesticides*, 120 PNAS 1 (2023); Dave Goulson et al., *Bee Declines Driven by Combined Stress From Parasites, Pesticides, and Lack of Flowers*, 347 Science 1255957-1 (2015); C.A. Brittain et al., *Impacts of a Pesticide on Pollinator Species Richness at Different Spatial Scales*, 11 Basic & Applied Ecology 106 (2010).

[45] In addition to the listed species named herein, the U.S. Fish and Wildlife Service has recently proposed to list the monarch butterfly (*Danaus plexippus*) as threatened under the ESA, citing insecticides and herbicides as major factors behind the decline of this species. *See* Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Monarch Butterfly and Designation of Critical Habitat, 89 Fed. Reg. 100,662, 100,672–73 (Dec. 12, 2024).

[46] Endangered and Threatened Wildlife and Plants; Endangered Species Status for Rusty Patched Bumble Bee, 82 Fed. Reg. 3,186, 3,188 (Jan. 11, 2017); U.S. Fish & Wildlife Serv., *Rusty Patched Bumble Bee* (*Bombus affinis*), https://www.fws.gov/sites/default/files/documents/508_RPBB-factsheet.pdf (last visited Oct. 10, 2024).

cranberries, clover, tree fruits, and tomatoes.[47] The U.S. Fish and Wildlife Service (FWS) considers pesticides a "key threat" to this species and, in its most recent rusty-patched bumble bee five-year status review, lists a number of reasons bumble bees may be more sensitive to pesticides than honey bees.[48] Indeed, EPA has designated the rusty-patched bumble bee a "vulnerable species" within its Vulnerable Listed Species Action Plan due to the species' "particular[] vulnerab[ility]" to pesticides and other stressors.[49]

The Poweshiek skipperling (*Oarisma poweshiek*), listed as endangered in 2014, is a prairie butterfly that was once common across eight states from Michigan to North Dakota.[50] The Poweshiek skipperling has experienced a "precipitous decline" due to a combination of factors including habitat conversion, incompatible land management practices, and the "indiscriminate use of pesticides."[51] As with the rusty-patched bumble bee, EPA has designated the Poweshiek skipperling a "vulnerable species" within its Vulnerable Listed Species Action Plan due to the species' "particular[] vulnerab[ility]" to pesticides and other stressors.[52]

Pursuant to its Draft Insecticide Strategy, EPA has further enumerated twelve butterfly and moth pollinator species that face potential "population-level impacts" from insecticides.[53] All twelve of these species are listed as endangered or threatened under the ESA.[54] A number of these species have extremely limited ranges. For example, the threatened Kern primrose sphinx moth (*Euproserpinus euterpe*) occurs only in several counties in Central and Southern California;[55] the endangered Saint Francis' satyr butterfly (*Neonympha mitchellii francisci*) population consists of "half a dozen small colonies that occupy a total area no larger than a few square miles" in North Carolina;[56] and the endangered Bartram's hairstreak (*Strymon acis bartrami*) and Florida leafwing (*Anaea troglodyta floridalis*) butterflies are both confined to a

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[47] U.S. Fish & Wildlife Serv., *supra* note 46.

[48] U.S. Fish & Wildlife Serv., *Rusty Patched Bumble Bee (Bombus affinis) Status Review: Summary and Evaluation* 15 (Aug. 2022), https://ecos.fws.gov/docs/tess/species_nonpublish/3911.pdf.

[49] U.S. EPA, *Action Plan to Reduce Exposure of Vulnerable Federally Listed Endangered and Threatened Species from the Use of Conventional Pesticides* 6, 30 (2024), https://www.regulations.gov/document/EPA-HQ-OPP-2023-0327-0208 [hereinafter "EPA Vulnerable Species Action Plan"].

[50] U.S. Fish & Wildlife Serv., Biological and Conference Opinion on the Registration of Malathion Pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act: Appendix K-A7 at 353 (2022), https://www.epa.gov/endangered-species/biological-opinions-available-public-comment-links-final-opinions-and-links.

[51] U.S. Fish & Wildlife Serv., *Recovery Plan for Poweshiek Skipperling* (Oarisma Poweshiek) 1 (2022), https://ecos.fws.gov/docs/recovery_plan/20220310_POSK_Final%20Recovery_Plan_508_1.pdf; Endangered and Threatened Wildlife and Plants; Threatened Species Status for Dakota Skipper and Endangered Species Status for Poweshiek Skipperling, 79 Fed. Reg. 63,672, 63,672 (Oct. 24, 2014).

[52] EPA Vulnerable Species Action Plan at 6, 30.

[53] U.S. EPA, *Draft Insecticide Strategy to Reduce Exposure of Federally Listed Endangered and Threatened Species and Designated Critical Habitats from the Use of Conventional Agricultural Insecticides* 5, 96 (July 25, 2024), https://www.regulations.gov/document/EPA-HQ-OPP-2024-0299-0005 [hereinafter "Draft Insecticide Strategy"].

[54] *See id.*

[55] *See* U.S. Fish & Wildlife Serv., *Kern Primrose Sphinx Moth* (Euproserpinus euterpe) *5-Year Review*, 1 (Jul. 20, 2020), https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/2993.pdf.

[56] *See* Endangered and Threatened Wildlife and Plants; Saint Francis' Satyr Determined To Be Endangered, 60 Fed. Reg. 5264, 5265 (Jan. 26, 1995).

small area within Florida's Everglades National Park, as this is the sole region that contains the only known host plant for these species, the pineland croton.[57] With such limited ranges, these and other species listed in the Draft Insecticide Strategy could be pushed past their respective tipping points by "population-level impacts" from insecticides.

Scientists have also identified pesticides as one of the most important anthropogenic causal factors behind "colony collapse disorder" among western honey bees. In the fall of 2006, beekeepers in the United States began reporting losses of 30 to 90 percent of their hives with no apparent cause.[58] A majority of worker bees in a colony would disappear—leaving behind no dead bodies—and high brood populations and a queen remained.[59] Colony collapse disorder (CCD) was termed to describe this phenomenon.[60] Researchers have posited that pesticide use is among the key factors that contribute to CCD.[61] Though few acute losses have been as significant as those first reports of CCD almost two decades ago, seasonal western honey bee losses remain high in some countries.[62] American beekeepers lost nearly half of their hives in the 2022–23 growing season, which represented one of the highest annual losses since recordkeeping began in 2008.[63]

Notably, efforts to limit the adverse impacts of pesticides on western honey bees will not necessarily protect other insect pollinators due to the wide variability in pesticide vulnerability across these thousands of taxa. Honey bees, bumble bees, and solitary bees all have distinct physiologies, life cycles, and behavioral patterns, and thus face widely varying degrees of risk to pesticides.[64] Butterflies and moths—also important pollinators—have even less in common with western honey bees than bumble bees and solitary bees.[65]

The foregoing declines in diverse pollinator populations have significant implications for human and non-human life alike. Pollination ranks among the most important services insects provide to human societies. Roughly one third of the world's volume of produced food benefits from animal pollination.[66] Pollination for commercial food production is valued at over $350 billion globally.[67] Even those crops for which pollination is inessential—for example, roots and tubers like potatoes and carrots—depend on pollination for their propagation via seeds or

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[57] *See* U.S. Fish & Wildlife Serv., *Bartram's Scrub-Hairstreak Butterfly* (Strymon acis bartrami) *5-Year Status Review*, 2–3 (Jul. 9, 2024), https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/14367.pdf; U.S. Fish & Wildlife Serv., *Florida Leafwing Butterfly* (Anaea troglodyta floridalis) *5-Year Status Review*, 2–3 (Aug. 18, 2023), https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/6348.pdf.

[58] U.S. Dep't of Agric., *Colony Collapse Disorder: An Incomplete Puzzle*, 4 (Jul. 2012), https://agresearchmag.ars.usda.gov/AR/archive/2012/Jul/colony0712.pdf.

[59] *Id.*

[60] *Id.*

[61] Peter Hristov et al., *Factors Associated with Honey Bee Colony Losses: A Mini-Review*, 7 Vet. Sci. 1 (2020).

[62] IPBES Pollinator Report at 153.

[63] Nathalie Steinhauer, *United States Honey Bee Colony Losses 2022–23: Preliminary Results From The Bee Informed Partnership* (June 22, 2023), https://beeinformed.org/2023/06/22/united-states-honey-bee-colony-losses-2022-23-preliminary-results-from-the-bee-informed-partnership/.

[64] *See infra* section III.C.i.

[65] *See infra* section III.C.ii.

[66] IPBES Pollinator Report at 3.

[67] *Id.* at xi.

breeding programs.[68] Researchers estimate that inadequate pollination of fruits, vegetables, and nuts leads to an estimated 427,000 excess deaths per year from lost healthy food consumption and associated diseases.[69]

Pollinating insects are also essential for sustaining global biodiversity. Pollinators play a central role in the stability and functioning of many terrestrial food webs: almost 90 percent of the world's flowering wild plants depend to some degree on animal pollination for sexual reproduction, and these plants provide food and shelter for many other species.[70] Diverse pollinator populations are critical to avert the growing issue of pollen limitation, where plants—particularly ecologically and functionally specialized plants—receive an inadequate quantity or quality of pollen and experience reduced reproductive success as a result.[71] Pollinators serve as important indicators of ecosystem health due to their high sensitivity to synthetic pollution.[72] Pollinators further play an important role in the natural control of pest and disease vectors.[73] Many of these ecological values remain understudied. Indeed, the rate of loss of pollinating insects may outpace scientists' ability to fully comprehend these values.[74]

II. EPA has a statutory responsibility to prevent unreasonable adverse effects of pesticides on the environment.

It is all the more troubling that our nation's intensive pesticide usage is taking such a massive toll on insect pollinators because it does not have to be this way. To the contrary, EPA has both the authority and the responsibility to prevent such harmful consequences of pesticide use. The Federal Insecticide, Fungicide, and Rodenticide Act charges EPA with the prevention and mitigation of adverse environmental impacts caused by pesticides, including the current crisis befalling insect pollinators. As discussed above, events over sixty years ago provided the impetus for FIFRA's modern-day environmental protections. Rachel Carson's *Silent Spring* lit a match that ignited widespread public awareness of the destruction wrought by indiscriminate use of the pesticide dichlorodiphenyltrichloroethane (DDT). Ten years later, Congress, in response to "mounting public concern about the safety of pesticides and their effect on the environment," as well as "a growing perception that . . . existing [pesticide] legislation was not equal to the task of safeguarding the public interest," substantially revised FIFRA.[75] Those 1972 amendments transformed FIFRA from a mere pesticide "labeling law" into a "comprehensive regulatory

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[68] *Id.* at xxviii.

[69] Matthew R. Smith et al., *Pollinator Deficits, Food Consumption, and Consequences for Human Health: A Modeling Study*, 130 Environmental Health Perspectives 1 (2022).

[70] IPBES Pollinator Report at xxviii.

[71] Daniel Mutavi Katumo et al., *Pollinator Diversity Benefits Natural and Agricultural Ecosystems, Environmental Health, and Human Welfare*, 44 Plant Diversity 429, 430 (2022); J.M. Bennett et al., *Data Descriptor: GloPL, a Global Data Base on Pollen Limitation of Plant Reproduction*, 5 Scientific Data 1, 2 (2019).

[72] Katumo et al., *supra* note 71, at 432.

[73] *Id.*

[74] *See* Nigel E. Stork, *How Many Species of Insects and Other Terrestrial Arthropods Are There on Earth*?, 63 Ann. Rev. of Entomology 33 (2018); Pedro Cardoso et al., *Scientists' Warning to Humanity on Insect Extinctions*, 242 Biological Conservation 1, 2 (2020).

[75] *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 991 (1984) (citing S. Rep. No. 92-838, at 3–9; S. Rep. No. 92-970, at 9 (1972); H.R. Rep. No. 92-511, at 5–13).

statute."[76] Congress's intent was clear: FIFRA must ensure that pesticides do not cause wanton ecological devastation of the type witnessed in the mid-20th century and that is increasingly apparent today.

Most notably, the 1972 amendments to FIFRA dictate that EPA may register or maintain registration of a pesticide only if the agency determines that the pesticide will not have "unreasonable adverse effects on the environment."[77] An "unreasonable adverse effect[] on the environment" includes "any unreasonable risk to [people] or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide."[78] FIFRA's legislative history makes clear that the prohibited "unreasonable adverse effects on the environment" are broad in scope:

> [T]he balancing of benefit against risk is supposed to take every relevant factor that the [EPA] Administrator can conceive of into account. The question he must decide is "Is it better for man and the environment to register this pesticide, or is it better that this pesticide be banned?" He must consider hazards to farmworkers, hazards to birds and animals and children yet unborn. He must consider the need for food and clothing and forest products, forest and grassland cover to keep the rain where it falls, prevent floods, provide clear water. He must consider aesthetic values, the beauty and inspiration of nature, the comfort and health of man. All these factors he must consider, giving each its due. No one should be given undue consideration, no one should be singled out for special mention, no one should be considered a "vital" criterion.[79]

Furthermore, in recognition of the fact that the science underlying pesticide registration may change over time—and new information of a pesticide's adverse environmental impacts may come to light—Congress dictated that EPA "publish guidelines specifying the kinds of information which will be required to support the registration of a pesticide and shall revise such guidelines from time to time."[80] If EPA "determines that additional data are required to maintain in effect an existing registration of a pesticide," the agency "shall notify" registrants of this extra required data and registrants must submit it within 90 days.[81] EPA may approve a pesticide registration only if it has "reviewed all relevant data in [its] possession" and "has determined that no additional data are necessary" to assess whether the pesticide will perform its intended function without "unreasonable adverse effects on the environment."[82] And every fifteen years, EPA must review the registration of a given pesticide to ensure it continues to meet standards for registration under FIFRA.[83] Registration review is designed to "ensure[] that older pesticides meet contemporary health and safety standards."[84]

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[76] *Id.*
[77] 7 U.S.C. § 136a(c)(5); *see also Ruckelshaus*, 467 U.S. at 992.
[78] 7 U.S.C. § 136(bb).
[79] S. Rep. No. 92-838, at 10 (1972).
[80] 7 U.S.C. § 136a(c)(2)(A).
[81] *Id.* § 136a(c)(2)(B).
[82] 40 C.F.R. § 152.112(b)–(c); 7 U.S.C. § 136a(c)(5).
[83] 7 U.S.C. § 136a(g)(1)(A)(i), (iii)(II).
[84] U.S. EPA, *Evaluation of the U.S. EPA Pesticide Product Reregistration Process: Opportunities for*

Finally, EPA is empowered to initiate cancellation proceedings for a pesticide registration if the pesticide "generally causes unreasonable adverse effects on the environment."[85] EPA may hold a hearing to "determine whether or not [a] registration should be canceled,"[86] in which case "the proponent of cancellation . . . has the burden of going forward to present an affirmative case" for the cancellation[87] but "the ultimate burden of persuasion shall rest with the proponent of the registration."[88]

III. EPA's pollinator data requirements are failing to prevent significant adverse effects of pesticides on the environment.

The data requirements that inform EPA's pollinator risk assessment urgently need updating to enable EPA to fulfill its statutory role of environmental stewardship. Pursuant to its obligations under FIFRA to avoid registering pesticides that have "unreasonable adverse effects on the environment,"[89] and to "publish guidelines specifying the kinds of information which will be required to support the registration of a pesticide,"[90] EPA has promulgated requirements and guidelines concerning the pollinator testing data pesticide registrants must submit to support registration of a pesticide. However, the testing requirements EPA has actually codified in the Code of Federal Regulations are quite limited. EPA unconditionally requires only one pollinator test, while two other tests are conditionally required; all three tests are only performed on adult honey bees as a test subject. Even where EPA does ask pesticide registrants to submit more pollinator data, EPA's failure to codify these testing requirements results in uneven regulatory supervision of the pesticide industry, data gaps in the pollinator risk assessment process, and delays in the registration process, including delayed adoption of essential measures to mitigate pesticides' harms. Finally, even EPA's testing requests made pursuant to inadequate, non-binding guidance do not reflect current scientific research or international risk-assessment standards regarding the importance of testing a broader range of pollinator species, including non-*Apis* bees and *Lepidoptera* species.

A. EPA has codified only three narrow pollinator data tests.

EPA has codified guidelines for only three tests pesticide registrants may be required to conduct to assess the impacts of a given pesticide on insect pollinators.[91] These codified pollinator data tests are quite narrow and have not been updated since 2007.[92] The three tests vary in the extent to which they mimic real-world pesticide exposure scenarios.[93] The more

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Efficiency and Innovation 1-1 (Mar. 2007), https://www.epa.gov/sites/production/files/2015-09/documents/eval-epa-pesticide-product-reregistration-process.pdf; 40 C.F.R. § 155.40.

[85] 7 U.S.C. § 136d(b).

[86] *Id.* § 136d(b)(2).

[87] 40 C.F.R. § 164.80(a).

[88] *Id.* § 164.80(b); *see also id.* § 164.81 (evidentiary standard).

[89] 7 U.S.C. § 136a(c)(5).

[90] *Id.* § 136a(c)(2).

[91] *See* 40 C.F.R. § 158.630(d).

[92] *See* Pesticides; Data Requirements for Conventional Chemicals, 72 Fed. Reg. 60,934, 60,979 (Oct. 26, 2007).

[93] EPA characterizes this as a "tiered" testing framework, where Tier I constitutes laboratory tests; Tier II constitutes "semi-field" tests; and Tier III constitutes "full-field" tests. *See* U.S. EPA, *Guidance for*

complex tests—which mimic real-world exposures—are "conditionally required" only if simpler laboratory tests show the potential for higher risk or uncertainties which must be resolved.[94]

The three tests are also required only for adult worker honey bees. No other species, life stage, or caste must be tested. Rather, EPA treats honey bee workers as a "surrogate" for all other insect pollinators—solitary bees, bumble bees, butterflies, moths, flies, and beetles—and other life stages and castes are simply left out of these codified requirements.[95] EPA recognizes the limitations of using honey bees as a surrogate for other bees but maintains that individual and colony-level honey bee data "provide some relevant information on the potential effects of a pesticide on both solitary bees as well as [social] taxa," and that "protection of honey bees would contribute to pollinator diversity indirectly by preserving the pollination and propagation of the many plants species pollinated by honey bees, which also serve as food sources for other pollinating insects."[96] It is worth noting further that EPA does not purport to analyze pesticide impacts to non-pollinating insects—aside from those species listed under the ESA—whatsoever.

EPA's first codified test examines the toxicity of a pesticide to a honey bee when it receives a topical, one-time dose of the pesticide test substance in a lab setting.[97] Known as the "honey bee acute contact toxicity test," it is required for pesticides with terrestrial, forestry, and residential outdoor uses—i.e., the vast majority of pesticides.[98] The study yields the test substance's median lethal dose, or LD_{50}, which is the dose of the test substance that causes 50 percent of the honey bee test population to die soon after exposure—usually within 24 or 48 hours.[99] EPA considers this test a "screening tool" which "employs conservative assumptions regarding exposure."[100] EPA has published guidelines for registrants to conduct the honey bee acute contact toxicity test.[101]

The second codified test involves the application of a pesticide to crop foliage, the harvesting of that foliage at specified intervals, and the exposure of honey bees to the pesticide-

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Assessing Pesticide Risks to Bees 6, 22–30 (June 19, 2014), https://www.epa.gov/sites/default/files/2014-06/documents/pollinator_risk_assessment_guidance_06_19_14.pdf [hereinafter "2014 Guidance"]. These three tiers are described comprehensively only in guidance documents and are not referenced in 40 C.F.R. § 158.630. *See id.*

[94] *See* U.S. EPA, *How We Assess Risks to Pollinators*, https://www.epa.gov/pollinator-protection/how-we-assess-risks-pollinators (last visited Dec. 6, 2024).

[95] 2014 Guidance at 13, 14 (acknowledging use of honey bees as a "surrogate for other insect pollinators").

[96] *Id.*

[97] EPA may require tests of four different substances: the technical grade of the active ingredient (TGAI); the typical end-use product (TEP); the pure active ingredient (PAI); and the end-use product (EP). *See* 40 C.F.R. § 158.630(c), (d) column 9. The honey bee acute contact toxicity test requires that registrants test only the technical grade of the active ingredient. *See id.* § 158.630(d). The typical end-use product need only be tested if EPA determines that higher-complexity pollinator tests—the honey bee toxicity of residues on foliage and field testing—are required. *Id.*

[98] 40 C.F.R. § 158.630(d).

[99] OCSPP Guideline 850.3020 provides that only honey bee deaths that occur within 48 hours of acute contact with the test substance should factor into the calculation of the LD_{50}. *See* U.S. EPA, *Ecological Effects Test Guidelines, OCSPP 850.3020: Honey Bee Acute Contact Toxicity Test* 1, 2–3, https://www.regulations.gov/document/EPA-HQ-OPPT-2009-0154-0016 (last visited Oct. 16, 2024) [hereinafter "OCSPP 850.3020: Acute Contact Toxicity"].

[100] *See* U.S. EPA, *supra* note 94.

[101] *See* OCSPP 850.3020: Acute Contact Toxicity; 40 C.F.R. § 158.630(d)–(e).

treated foliage for twenty-four-hour periods.[102] Known as the "honey bee toxicity of residues on foliage" test, this test yields a pesticide's "residual toxicity," or the amount of time the pesticide is expected to remain toxic to bees following application.[103] This test will be required "only when the [typical end-use product] contains one or more active ingredients having an acute LD_{50} of [less than] 11 micrograms per bee as determined in the honey bee acute contact study and the use pattern(s) indicate(s) that honey bees may be exposed to the pesticide."[104] EPA has published guidelines for registrants to conduct the "honey bee toxicity of residues on foliage" test.[105]

Finally, the third codified test is the sole of the three pollinator tests that purports to mimic pesticide exposure in real-world, "field" conditions.[106] EPA has published guidelines for this test, known as "field testing for pollinators," but the agency acknowledges that these guidelines are "relatively generic" because necessary field testing will vary from case to case.[107] This level of testing is intended to address specific uncertainties that have arisen in earlier rounds of testing or in the open literature.[108] Under EPA's guidelines, field testing will be required if any of a number of specified conditions are met.[109] EPA also routinely waives the regulatory requirement for field testing.[110]

These three tests constitute the entirety of EPA's codified insect pollinator testing requirements under 40 C.F.R. Part 158.

B. Because EPA requests most pollinator testing data pursuant to non-codified guidance, there are significant data gaps and delays in the pesticide registration and registration review processes.

EPA requests pollinator data of registrants beyond the requirements under 40 C.F.R. Part 158, but these requests are made pursuant to non-binding, non-codified guidance documents. As a result, EPA does not consistently collect many categories of essential data, and the registration review process can be delayed by the agency's lack of transparency as to which data will be

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[102] *See* U.S. EPA, *Ecological Effects Test Guidelines, OCSPP 850.3030: Honey Bee Toxicity of Residues on Foliage*, https://www.regulations.gov/document/EPA-HQ-OPPT-2009-0154-0017 (last visited Oct. 28, 2024) [hereinafter "OCSPP 850.3030: Residues on Foliage"].

[103] *Id.*

[104] 40 C.F.R. § 158.630(e) n.24.

[105] *See* OCSPP 850.3030: Residues on Foliage.

[106] *See* 40 C.F.R. § 158.630(d).

[107] 2014 Guidance at 27; U.S. EPA, *Ecological Effects Test Guidelines, OCSPP 850.3040: Field Testing for Pollinators*, https://www.regulations.gov/document/EPA-HQ-OPPT-2009-0154-0018 (last visited Oct. 28, 2024) [hereinafter "OCSPP 850.3040: Field Testing"].

[108] 2014 Guidance at 27.

[109] Field testing will be required where: "i. Data from other sources . . . indicate potential adverse effects on colonies, especially effects other than acute mortality (reproductive, behavioral, etc.); ii. Data from residual toxicity studies indicate extended residual toxicity; [or] iii. Data derived from studies with terrestrial arthropods other than bees indicate potential chronic, reproductive or behavioral effects." 40 C.F.R. § 158.630(e) n.25.

[110] *See, e.g.*, U.S. EPA, *Sulfoxaflor: Ecological Risk Assessment for Section 3 Registration for Various Proposed New Uses* 134 (July 10, 2019), https://www.regulations.gov/document/EPA-HQ-OPP-2010-0889-0566 ("A Tier III [full field] study has not been submitted with sulfoxaflor and the registrant has requested a waiver for this study per 40 CFR Part 158.630 . . . . [T]he Agency granted the requested waiver . . . . ").

required of registrants—which, in turn, can delay the adoption of critical measures to prevent unreasonable risk. Aside from the codified pollinator tests described above, EPA requests data described in four non-binding guidance documents: the White Paper in Support of the Proposed Risk Assessment Process for Bees (the "2012 White Paper");[111] the 2014 "Guidance for Assessing Pesticide Risks to Bees" (the "2014 Guidance");[112] the 2016 "Guidance on Exposure and Effects Testing for Assessing Risks to Bees" (the "2016 Testing Guidance");[113] and the 2016 "Process for Requiring Exposure and Effects Testing for Assessing Risks to Bees during Registration and Registration Review" (the "2016 Process Guidance").[114]

The 2012 White Paper recommends the collection of a number of pollinator data categories not captured by the codified tests. Specifically, the 2012 White Paper recommends: acute oral toxicity and chronic toxicity testing, whereas EPA has codified only acute contact toxicity testing;[115] larval/pupal honey bee testing, whereas EPA has codified the testing of only adults;[116] and testing of individuals of different castes—such as queens and drones, which have different diets and energetic requirements—whereas EPA has codified the testing of only workers.[117] The 2014 Guidance adopted these recommendations and EPA began requesting these categories of data from registrants at that time.[118] Two years later, the 2016 Testing Guidance explained the agency's need for these and other non-codified categories of data in its pollinator risk assessment, including honey bee adult acute oral toxicity, honey bee larvae acute oral toxicity, honey bee adult chronic oral toxicity, and honey bee larvae chronic oral toxicity.[119] The accompanying 2016 Process Guidance clarified the instances in which EPA would recommend those and other additional bee testing categories described in both the 2014 Guidance and 2016 Testing Guidance.[120] Because the recommended data categories in the foregoing guidance documents are not codified, EPA must use its FIFRA data call-in authority to request these data of registrants.[121]

EPA's failure to codify the categories of pollinator data recommended in the four guidance documents results in uneven regulatory oversight, data gaps, and delays in EPA's

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[111] U.S. EPA, Office of Chemical Safety and Pollution Prevention: Office of Pesticide Programs, *White Paper in Support of the Proposed Risk Assessment Process for Bees* (Sept. 11, 2012), https://www.regulations.gov/document/EPA-HQ-OPP-2012-0543-0004 [hereinafter "2012 White Paper"].

[112] *See* U.S. EPA, *Guidance for Assessing Pesticide Risks to Bees* (June 19, 2014), https://www.epa.gov/sites/default/files/2014-06/documents/pollinator_risk_assessment_guidance_06_19_14.pdf.

[113] *See* U.S. EPA, *Guidance on Exposure and Effects Testing for Assessing Risks to Bees* (July 5, 2016), https://www.epa.gov/sites/default/files/2016-07/documents/guidance-exposure-effects-testing-assessing-risks-bees.pdf [hereinafter "2016 Testing Guidance"].

[114] *See* U.S. EPA, *Process for Requiring Exposure and Effects Testing for Assessing Risks to Bees During Registration and Registration Review* (August 15, 2016), https://www.epa.gov/sites/default/files/2016-08/documents/bee_guidance.pdf [hereinafter "2016 Process Guidance"].

[115] *See* 2012 White Paper at 29, 59, 104, 105.

[116] *See id.* at 29, 59, 104, 105, 108–09.

[117] *See id.* at 195–200.

[118] *See* 2014 Guidance at 2, 13, 15, 16, 19–20; *see also* OCSPP 850.3020: Acute Contact Toxicity at 3; OCSPP 850.3030: Residues on Foliage at 2. Note that 40 C.F.R. § 158.630 does not state any express age or caste requirement for pollinator test organisms.

[119] 2016 Testing Guidance at 13–21, 27–35.

[120] 2016 Process Guidance at 17–18.

[121] *See* 7 U.S.C. § 136a(c)(2)(B); 2016 Process Guidance at 8, 10.

pollinator risk assessment process. First, EPA does not consistently request non-codified data of registrants, and the agency has conducted risk assessments without having requested or received such data. For example, EPA did not require registrants to submit honey bee larvae acute oral toxicity data for the 2020 bee risk assessments to support the registration reviews of the lethal neonicotinoids imidacloprid, clothianidin, or thiamethoxam, and did not explain those decisions.[122] Courts have even vacated pesticide registration decisions on the basis of EPA's failure to collect pollinator data sufficient to render the registration decision reasonable, underscoring the inconsistency of EPA's collection of non-codified data.[123] Second, even where registrants do submit data in response to data call-in requests by EPA, registrants are not required to comply with standardized testing protocols, such as those promulgated by the Organization for Economic Cooperation and Development (OECD).[124] This lack of standardization yields testing data that are not easy to compare across different species, test substances, or other metrics.[125] Finally, EPA has admitted that data requests made pursuant to its data call-in authority can result in delays in the registration and registration review processes, whereas, according to the agency, "[h]aving all required studies available to the EPA at the time of application should reduce the

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[122] *See* U.S. EPA, *Final Bee Risk Assessment to Support the Registration Review of Imidacloprid* 146 (Jan. 14, 2020), https://www.regulations.gov/document/EPA-HQ-OPP-2008-0844-1611 [hereinafter "Imidacloprid 2020 Bee Risk Assessment"]; U.S. EPA, *Appendices to the Final Bee Risk Assessment for Clothianidin (PC code 044309) and Thiamethoxam (PC code 060109)* 87 (Jan. 14, 2020), https://www.regulations.gov/document/EPA-HQ-OPP-2011-0865-1165.

[123] *See Migrant Clinicians Network v. U.S. Env't Prot. Agency*, 88 F.4th 830, 842–45 (9th Cir. 2023) (vacating amended registration of pesticide streptomycin in part due to EPA's failure to collect data necessary to ascertain pesticide's impacts on pollinators, including data on "potential toxicity to larval and adult honey bees"); *Pollinator Stewardship Council v. U.S. E.P.A.*, 806 F.3d 520, 528–33 (9th Cir. 2015) (vacating registration of pesticide sulfoxaflor due to EPA's failure to require honey bee semi-field studies at registrant's proposed pesticide application rates despite agency's own admission that such studies were essential).

[124] *See* Organization for Economic Co-Operation and Development, *Test No. 213: Honeybees, Acute Oral Toxicity Test* (Sept. 21, 1998), https://www.oecd.org/en/publications/test-no-213-honeybees-acute-oral-toxicity-test_9789264070165-en.html; Organization for Economic Co-Operation and Development, *Test No. 237: Honey Bee* (Apis Mellifera) *Larval Toxicity Test, Single Exposure* (July 26, 2013), https://www.oecd.org/en/publications/test-no-237-honey-bee-apis-mellifera-larval-toxicity-test-single-exposure_9789264203723-en.html; Organization for Economic Co-Operation and Development, *Test No. 245: Honey Bee* (Apis Mellifera L.), *Chronic Oral Toxicity Test (10-Day Feeding)* (Oct. 9, 2017), https://www.oecd.org/en/publications/test-no-245-honey-bee-apis-mellifera-l-chronic-oral-toxicity-test-10-day-feeding_9789264284081-en.html; Organization for Economic Co-Operation and Development, *Guidance Document on Honey Bee* (Apis mellifera) *Larval Toxicity Test, Repeated Exposure* (July 7, 2021), https://one.oecd.org/document/ENV/JM/MONO(2016)34/en/pdf. Note that while registrants are not required to comply with OECD test guidelines, they are permitted to do so. *See* 40 C.F.R. § 158.70(d)(2).

[125] *See, e.g.*, Imidacloprid 2020 Bee Risk Assessment at 147 (describing a registrant-submitted study of honey bee larvae chronic oral toxicity pursuant to test protocol recommendations of Aupinel et al. (2009) as opposed to OECD test guidelines); *Pollinator Stewardship Council*, 806 F.3d at 526–27, 528–29 (noting that some deficiencies in registrant-submitted honey bee semi-field studies "would have been ameliorated . . . had the studies conformed with OECD guidance" because, among other things, "proper controls could have been used, the studies could have been replicated more times, and the bees could have been observed for a longer period of time after being removed from the tunnels").

potential" for those delays."[126] In many instances, the delay of a registration review decision means the delay of essential measures to mitigate the adverse impacts of pesticides on the environment, as the pesticides being examined by EPA are already in widespread use even as the review proceeds. EPA has further acknowledged that codifying regularly requested data requirements increases transparency and notice to the regulated community as to which data will be required in the registration process.[127]

EPA's recognition of the value of codification of pollinator data requirements is best evidenced by the agency's past attempts to codify the non-binding guidelines. In 2015, EPA initiated a rulemaking process to codify additional testing categories in the 2016 Process Guidance at 40 C.F.R. Part 158.[128] EPA explained that the 2016 Process Guidance was meant to provide guidance on only an "interim" basis pending this completed rulemaking, which EPA projected to be effective by "mid-late 2017."[129] But to this day, EPA has not completed or even reinitiated that rulemaking.

C. Even the non-binding pollinator risk assessment guidance is outdated and fails to reflect current scientific research.

Not only have they never been embodied in mandatory regulations, EPA's four pollinator risk assessment guidance documents—all averaging a decade old—do not reflect current scientific research regarding the true toll of pesticides on insect pollinator populations. Because even these four non-binding guidance documents do not recommend that EPA collect certain essential categories of data, EPA's pollinator risk assessment vastly underestimates the threat pesticides pose to pollinating insects.

Over the last several decades, and as detailed below, scientific research has shown that honey bees are unfit surrogates for solitary and bumble bees due to physiological, life cycle, and behavioral differences between these bee taxa, yet EPA continues to follow outdated guidance treating honey bees as a surrogate for all pollinating insects. And scientific research has shown that declines in non-target butterfly and moth populations have been linked to pesticides, yet EPA continues to follow outdated guidance that does not recommend the testing of pesticide impacts to non-target *Lepidoptera* whatsoever. Due to these shortcomings, a codification of the testing recommended in EPA's four pollinator risk assessment guidance documents by itself would not bring EPA into compliance with FIFRA's mandate that the agency avoid registering pesticides that have "unreasonable adverse effects on the environment."[130]

i. Honey bees are not an adequate surrogate for other bee pollinators.

In each of the four non-binding documents that guide EPA's pollinator risk assessment, EPA recommends the testing of only honey bees, and no other insect pollinators. EPA does not engage in any kind of modeling or other analysis to estimate impacts to non-*Apis* bees or other

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[126] 2016 EPA Process Guidance at 5.

[127] *See* Pesticides; Data Requirements for Conventional Chemicals, 72 Fed. Reg. 60,934, 60,934 (Oct. 26, 2007) (noting that updating the pollinator data requirements table at 40 C.F.R. Part 158 would have the benefit of "providing the regulated community with clearer and more transparent information").

[128] 2016 Process Guidance at 4, 7–8.

[129] *Id.* at 4, 8.

[130] *See* 7 U.S.C. § 136a(c)(5)(D).

insect pollinators based on the testing of *Apis* bees.[131] Rather, EPA accepts the fiction that honey bees are an appropriate "surrogate" for other bee pollinators and individual and colony-level honey bee data "provide some relevant information on the potential effects of a pesticide on both solitary bees as well as [social] taxa."[132] But the volume of relevant information is limited indeed and falls far short of the information needed to assess a pesticide's potential for unreasonable adverse effects on the environment.

There are roughly 4,000 species of wild, native bees in the United States.[133] Native bee species play a significant and often overlooked role in the pollination of the nation's fruits, nuts, and vegetables, 75 percent of which are pollinated by bees generally.[134] Diverse pollinator communities tend to provide more effective and stable crop pollination than any single pollinator species.[135] Managed honey bees often cannot fully compensate for the loss of wild pollinators, can be less effective pollinators for certain crops, and cannot always be supplied in sufficient volumes to meet demand.[136] A recent study found that for seven crops, including apples and pumpkins, wild bees were responsible for over $1.5 billion in annual production nationwide.[137] In the United States, wild bee abundance is declining most severely where crop pollination services are needed most.[138] Native bees are also the sole pollinators for numerous native plant species.[139]

This country's native bees include solitary bees and bumble bees, both of which vary substantially in physiology, life cycle, and behavior as compared to the non-native honey bee. The vast majority of bee species are solitary, which means that a single reproductive female creates a nest and provisions it without workers, and she does not make honey.[140] Many solitary bees, such as leaf-cutting bees (*Megachile* spp.) and alkali bees (*Nomia melanderi*), burrow in the ground to nest.[141] Others, such as mason bees (*Osmia* spp.), nest in preexisting holes and

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[131] At least one court has held that FWS violated the ESA by allowing EPA to use "surrogate" species to assess pesticide impacts, without the application of a safety factor to account for the "great variability in the sensitivity of species to any given pesticide." *Washington Toxics Coal. v. U.S. Dep't of Interior, Fish & Wildlife Serv.*, 457 F. Supp. 2d 1158, 1189–90 (W.D. Wash. 2006). The court noted FWS's own observation that "results among standard test species . . . indicate that it's difficult to make generalizations regarding pesticide sensitivity as responses are often chemical specific and can vary by orders of magnitude even in closely related species," highlighting the importance of safety factors where surrogate species are used. *Id.* at 1189.

[132] 2014 Guidance at 13.

[133] U.S. Forest Serv., *Bee Pollination*, https://www.fs.usda.gov/wildflowers/pollinators/animals/bees.shtml (last visited Oct. 28, 2024).

[134] U.S. Forest Serv., *Bee Basics: An Introduction to Our Native Bees* 2 (Mar. 2011), https://efotg.sc.egov.usda.gov/references/public/SC/Bee_Basics_North_American_Bee_ID.pdf.

[135] IPBES Pollinator Report at xx.

[136] *Id.* at xxxiii.

[137] *See* J.R. Reilly et al., *Crop Production in the USA is Frequently Limited by a Lack of Pollinators*, 287 Proceedings of the Royal Society 1 (2020).

[138] *See* Insu Koh et al., *Modeling the Status, Trends, and Impacts of Wild Bee Abundance in the United States*, 113 PNAS 1 (2016).

[139] *See* Research Institute of Organic Agriculture, Wild Bees and Pollination: Fact Sheet 2, https://www.fibl.org/fileadmin/documents/shop/1645-wild-bees.pdf (last visited Nov. 15, 2024).

[140] Joseph S. Wilson & Olivia J. Messinger Carril, *The Bees in Your Backyard: A Guide to North America's Bees* 18–19 (2016).

[141] *Id.* at 18–19; 149–150; 141–43.

cavities in deadwood, and collect mud for nest construction.[142] Some solitary bee species are commercially managed for pollination because they are more efficient pollinators of certain crops than honey bees. For example, because *Osmia* bees visit more flowers per minute and transfer pollen between flowers more effectively than honey bees,[143] some are managed for the commercial pollination of apples and cherries (the blue orchard bee [*Osmia lignaria*] and the Japanese hornfaced bee [*Osmia cornifrons*]) and almonds and plums (blue orchard bee).[144] Alkali bees and alfalfa leaf-cutting bees (*Megachile rotundata*) are also intensively managed to pollinate alfalfa, as honey bees collect alfalfa nectar but rarely pollinate alfalfa flowers.[145] The solitary squash bee (*Peponapis limitaris*) is the most important pollinator of pumpkins.[146]

Bumble bees (*Bombus* spp.), by contrast, are among the few bees native to this continent that are truly social.[147] There are about 50 bumble bee species historically native to North America.[148] Unlike in honey bees, where queens live multiple years and colonies are perennial, *Bombus* queens live for only a single year and colonies are annual, only existing seasonally during warmer months. *Bombus* colonies are anywhere from 60 to 300 times smaller than honey bee hives.[149] Most *Bombus* bee species nest in the ground, often in preexisting cavities like abandoned rodent burrows.[150] As comparatively generalist foragers, *Bombus* bees visit a wide variety of plants. For many crops, *Bombus* bee pollination produces larger fruit, faster fruit development, and higher yields than honey bee pollination.[151] There are several reasons for this. First, unlike honey bees, *Bombus* bees are capable of "buzz" pollination, which means *Bombus* bees are much more effective pollinators of certain crops—such as tomatoes, potatoes, and peppers—for which pollen is stored in anthers that must be shaken to be released.[152] Second, *Bombus* bees work more quickly than honey bees, visiting twice as many flowers per minute.[153] Finally, *Bombus* bees can remain active in colder temperatures, fly at higher elevations, and carry more pollen than honey bees.[154]

Meanwhile, EPA's surrogate species, the non-native western European honey bee (*Apis mellifera*),[155] features traits entirely distinct from its bumble bee and solitary bee relatives. *Apis* bees are the only highly "eusocial" bees, or truly social bees.[156] Among other things, this means

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[142] *Id.* at 166; Christine Cairns Fortuin et al., *Mason Bees (Hymenoptera: Megachilidae) Exhibit No Avoidance of Imidacloprid-Treated Soils*, 50 Environmental Entomology 1438 (2021).
[143] Wilson & Carril, *supra* note 140, at 163.
[144] *Id.* at 163–64.
[145] *Id.* at 142, 186; James H. Cane, *The Extraordinary Alkali Bee,* Nomia melanderi (Halictidae)*, the World's Only Intensively Managed Ground-Nesting Bee*, 69 Annu. Rev. Entomol. 99, 100 (2024).
[146] *See* María Azucena Canto-Aguilar & Víctor Parra-Tabla, *Importance of Conserving Alternative Pollinators: Assessing the Pollination Efficiency of the Squash Bee,* Peponapis limitaris *in* Cucurbita Moschata (Cucurbitaceae), 4 J. of Insect Conservation 203 (2000).
[147] Wilson & Carril, *supra* note 140, at 242.
[148] *Id.*
[149] *Id.* at 245.
[150] *Id.*
[151] *Id.* at 243.
[152] *Id.* at 21, 243.
[153] *Id.* at 243.
[154] *Id.* at 243–44.
[155] European colonists brought the western European honey bee to North America in the seventeenth century. *See id.* at 246.
[156] *Id.* at 20.

that all individuals share a nest and divide responsibilities for nest making and care of a queen bee's offspring.[157] A single *Apis* colony can contain 60,000 individuals.[158] *Apis mellifera* also vary from most other North American bees by being one of the few to produce large amounts of honey; feral (non-managed) *Apis* bees consume the honey during colder months when floral resources are scarce.[159] That said, *Apis mellifera* are able to forage in a wide range of temperatures and are considered generalist foragers.[160] For these and other reasons, humans depend on managed western European honey bees to pollinate crops on a massive scale. The western European honey bee accounts for nearly 80 percent of all crop pollination in the United States, representing roughly $15 billion worth of crops annually.[161]

Due to their distinct physiologies, life cycles, and behavioral patterns, solitary bees, bumble bees, and honey bees face varying susceptibility to harms from pesticides. An ever-growing body of research shows that, because solitary, bumble, and honey bee species are exposed to pesticides at different rates and have different responses to pesticide exposure, the use of individual bee species as "surrogates" for other bee species underestimates pesticide risks to many bee species.[162] In particular, researchers have denounced the practice of treating *Apis* bees as a surrogate for all non-*Apis* bees.[163] In a recent meta-analysis of western honey bee and wild bee exposures to neonicotinoids, researchers found that neonicotinoid sensitivity—captured by the median lethal dose—varied among bee species by up to six orders of magnitude.[164] In another systematic review of pesticide impacts on *Apis* and non-*Apis* bee species, researchers found that non-*Apis* bee species were more sensitive to pesticides in over one third of cases, and in 5 percent of cases, non-*Apis* bee species were ten times more sensitive to pesticides than *Apis*

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[157] *Id.*

[158] *Id.* at 245.

[159] *Id.* at 246.

[160] *Id.* at 245.

[161] *Id.* at 247.

[162] *See* René S. Shahmohamadloo et al., *Risk Assessments Underestimate Threat of Pesticides to Wild Bees*, 17 Conservation Letters 1 (2024); Amelie Schmolke et al., *Assessment of the Vulnerability to Pesticide Exposures Across Bee Species*, 40 Environmental Toxicology and Chemistry 2640 (2021); John E. Banks et al., *Parasitoids and Ecological Risk Assessment: Can Toxicity Data Developed for One Species be Used to Protect an Entire Guild?*, 59 Biological Control 336 (2011); Elizabeth L. Franklin & Nigel E. Raine, *Moving Beyond Honeybee-centric Pesticide Risk Assessments to Protect All Pollinators*, 3 Nature Ecology & Evolution, 1373 (2019); Nigel E. Raine & Maj Rundlöf, *Pesticide Exposure and Effects on Non-Apis Bees*, 69 Annual Review of Entomology, 551 (2024); Harry Siviter et al., *Field-realistic Neonicotinoid Exposure has Sub-lethal Effects on Non-Apis Bees: A Meta-analysis*, 24 Ecology Letters 2586 (2021); Alicja Witwicka et al., *Expression of Subunits of an Insecticide Target Receptor Varies Across Tissues, Life Stages, Castes, and Species of Social Bees*, 32 Molecular Ecology 1034, 1034–35 (2022).

[163] *See* Shahmohamadloo et al., *supra* note 162, at 1; Schmolke et al., *supra* note 162, at 2640; Banks et al., *supra* note 162, at 336; Franklin & Raine, *supra* note 162, at 1373; Raine & Rundlöf, *supra* note 162, at 551; Siviter et al., *supra* note 162, at 2586; Witwicka et al., *supra* note 162, at 1034.

[164] Shahmohamadloo et al., *supra* note 162, at 1; *see also* Schmolke et al., *supra* note 162, at 2640; David J. Biddinger et al., *Comparative Toxicities and Synergism of Apple Orchard Pesticides to Apis mellifera (L.) and Osmia cornifrons (Radoszkowski)*, 8 PLoS ONE 1, 3 (2013); Maj Rundlöf et al., *Seed Coating With a Neonicotinoid Insecticide Negatively Affects Wild Bees*, 521 Nature 77 (2015); Melissa C. Hardstone & Jeffrey G. Scott, *Is Apis mellifera More Sensitive to Insecticides Than Other Insects?*, 66 Pest Manag. Sci. 1171 (2010); James E. Cresswell et al., *Differential Sensitivity of Honey Bees and Bumble Bees to a Dietary Insecticide (Imidacloprid)*, 115 Zoology 365 (2012).

species.[165] In short, honey bee pesticide responses cannot be extrapolated to meaningfully evaluate pesticide responses among other bees.

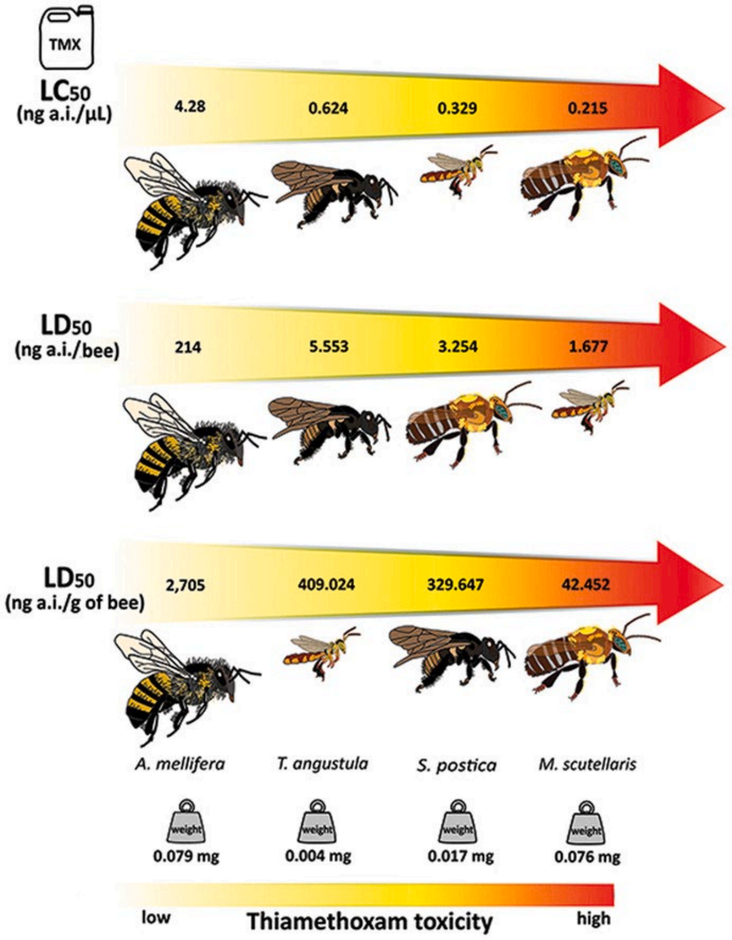

Figure 2: Oral LD$_{50}$ values from dietary exposure to the neonicotinoid thiamethoxam compared across bee species, with consideration of species weight (bottom) and without (middle). *Apis mellifera* are compared to three wild stingless bee species: *Tetragonisca angustula*, *Scaptotrigona postica*, and *Melipona scutellaris*. *Apis mellifera* are less sensitive to thiamethoxam than the three stingless bee species in every instance.[166]

Researchers have discussed myriad reasons solitary bees, bumble bees, and honey bees experience these varying vulnerabilities to pesticides. Bees in these three groups average different sizes; the high surface-area-to-volume ratio of smaller bees—like some *Osmia*—

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[165] Maria Arena & Fabio Sgolastra, *A Meta-analysis Comparing the Sensitivity of Bees to Pesticides*, 23 Ecotoxicology 324, 328 (2014); *see also* Blair Sampson et al., *Sensitivity to Imidacloprid Insecticide Varies Among Some Social and Solitary Bee Species of Agricultural Value*, 18 PLoS ONE 1 (2023).

[166] *See* Ana Paula Salomé Lourencetti et al., *Surrogate Species in Pesticide Risk Assessments: Toxicological Data of Three Stingless Bee Species*, 318 Environmental Pollution 1 (2023) (graphical abstract).

increases contact absorption of pesticides.[167] Many solitary bees also nest in the ground, or require mud for nest construction, which represents two exposure pathways for solitary bees—soil and mud—that honey bees do not experience.[168] Soil is likely a significant exposure pathway for solitary bees, given the ubiquity of treated seeds and the water solubility of the systemic insecticides applied to those seeds.[169]

In addition, solitary and bumble bees are much more vulnerable to population-level impacts of pesticides than honey bees: honey bees have large hives and therefore can absorb the loss of more individual workers due to "organizational redundancy," while bumble bee hives are significantly smaller than honey bee hives, and solitary bees have no analogous hive structure.[170] Bumble bees also forage at a much higher rate than solitary or honey bees, so the impacts of pesticide exposure for bumble bees compound on foraging and learning behavior at a greater rate.[171] Interestingly, bumble bees' greater sensitivity to neonicotinoids as compared to honey bees may be explained by honey bees' better pre-adaptation to feed on nectars containing synthetic alkaloids, like some neonicotinoids, by virtue of their evolutionary adaptation to tropical nectars containing such alkaloids—an adaptation not documented in native bees.[172]

The foregoing research makes clear that EPA's 2012–16-era guidance documents do not reflect contemporary scientific understandings that solitary bees, bumble bees, and honey bees face widely varying pesticide risks, and thus, honey bees cannot serve as an adequate surrogate for the other two classes. But even at the time of publication of the oldest of EPA's non-binding guidance documents, there were strong indications that EPA's usage of honey bees as a surrogate for other bees was inappropriate. In its 2012 White Paper, EPA itself acknowledged that "the need for [a formal risk assessment process specific to non-*Apis* bees] is clear," due to the "potential differences in sensitivity and exposure compared to [the] honey bee."[173] Even twelve years ago, EPA was able to compile an extensive list of biological and ecological traits of non-*Apis* bees which "lead to important differences in the route and extent to which [non-*Apis* bees] may be exposed to pesticides compared to honey bees":[174]

> [M]any non-*Apis* bees are smaller in size and thus, would receive a higher dose on a contact exposure basis . . . . Most non-*Apis* bees are solitary nesting species and

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[167] *See* Claire Brittain & Simon G. Potts, *The Potential Impacts of Insecticides on the Life-history Traits of Bees and the Consequences for Pollination*, 12 Basic & Applied Ecology 321, 324 (2011); Wilson & Carril, *supra* note 140, at 162–63.

[168] Anson R. Main et al., *Reduced Species Richness of Native Bees in Field Margins Associated with Neonicotinoid Concentrations in Non-target Soils*, 287 Agriculture Ecosystems and Environment 1 (2020); D.S. Willis Chan & Nigel E. Raine, *Population Decline in a Ground-nesting Solitary Squash Bee (Eucera pruinosa) Following Exposure to a Neonicotinoid Insecticide Treated Crop (Cucurbita pepo)*, 11 Scientific Reports 1 (2021); Harry Siviter et al., *Wild Bees are Exposed to Low Levels of Pesticides in Urban Grasslands and Community Gardens*, 858 Science of the Total Environment 1 (2023); *see also* Wilson & Carril, *supra* note 140, at 150, 162, 166, 180, 188 (describing bees that require mud for nest construction).

[169] Francisco Sánchez-Bayo, *The Trouble with Neonicotinoids*, 346 Science 806 (2014)

[170] *See* Franklin & Raine, *supra* note 162, at 1373; *see also* Schmolke et al., *supra* note 162, at 2642.

[171] Harry Siviter et al., *Bumblebees Exposed to a Neonicotinoid Pesticide Make Suboptimal Foraging Decisions*, 50 Environmental Entomology 1299 (2021).

[172] Cresswell et al., *supra* note 164, at 365.

[173] 2012 White Paper at 157.

[174] *Id.*

> therefore, loss of a single nesting adult would have a much greater consequence on reproduction . . . compared to the loss of a single adult foraging honey bee. Furthermore, the foraging range of non-*Apis* bees tends to be much smaller than that of honey bees . . . [so] non-*Apis* bees . . . may be exposed to pesticides at a higher proportion of their foraging area compared to honey bees . . . . For ground nesting bees, exposure via direct contact with soil . . . may be a major route of exposure unlike that for the honey bee. Soil and leaf material are known to be used extensively by some non-*Apis* bees for nest construction, which may lead to different types of exposures . . . .[175]

These significant inter-species differences notwithstanding, EPA claimed that the toxicity testing methods then available for evaluating pesticide effects to non-*Apis* bees had "not been sufficiently vetted . . . to support their use in quantifying risks to these other taxa."[176]

However, the FIFRA Scientific Advisory Panel (SAP), commenting on EPA's 2012 White Paper, did not countenance EPA's dismissal of the need for non-*Apis* testing. Among many other issues, the SAP commented on the protection goals articulated in the White Paper and the White Paper's endorsement of honey bees as a surrogate for non-*Apis* bees.[177] Specifically, while the White Paper named "contribution to pollinator biodiversity" as a protection goal for the pesticide risk assessment,[178] the FIFRA SAP noted that "pollinators are comprised of large numbers of organisms that include not only bee species but many other pollinating insects," and the White Paper offered "no means of assessing species diversity using only one surrogate species, the honey bee."[179] Commenting further on EPA's purported goal of "contribution to pollinator biodiversity," the FIFRA SAP noted that "the honey bee is a domesticated organism that is not native to the Americas,"[180] suggesting that conservation of honey bees does not further ends of conserving native pollinator biodiversity.

The FIFRA SAP also cautioned that, if EPA were to continue using honey bees as a surrogate species, "[I]t [would be] important to consider the differences between honey [bees] (*Apis mellifera*) and other bees":

> For example, some non-Apis bees may consume proportionately more pollen and less nectar. . . . [T]hese differences in consumption rates may impact dietary exposure estimates. Also, honey bees do not frequent soil while other bees do. . . . The Agency's white paper does not have risk diagrams that take into account this potential exposure pathway when non-systemic pesticides are applied to the soil . . . . [H]oney bees have the capability of recruiting more workers from the young nurse bees, if necessary. In the case of solitary bees, all females are queens. Thus,

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[175] *Id.* at 158.

[176] *Id.* at 5.

[177] *See* U.S. EPA, Transmittal of Meeting Minutes of the FIFRA Scientific Advisory Panel Meeting held September 11-14, 2012 on "Pollinator Risk Assessment Framework" (Dec. 11, 2012) at 11–15, 40–44, https://www.epa.gov/sites/default/files/2015-06/documents/091112minutes.pdf [hereinafter "FIFRA SAP Comments on 2012 White Paper"].

[178] *Id.* at 40.

[179] *Id.* at 11–12, 40–41.

[180] *Id.* at 11–12.

> adult mortality could have a greater impact on these bee populations in the following year than would be the case for honey bees.[181]

Given these differences, the FIFRA SAP "recommend[ed] that [EPA] require testing on at least one additional species to address the stated goal of protecting [pollinator] diversity."[182] The FIFRA SAP offered that *Osmia* bees and the alfalfa leafcutting bee (*Megachile rotundata*) are all "commercially available" and "would likely be relatively easy to include" as test organisms for the pollinator risk assessment.[183] "Bumble bees," too, are "commercially available," and "may be appropriate for use" in the risk assessment, the FIFRA SAP wrote to EPA.[184]

Nevertheless, in the 2014 Guidance, which purported to operationalize the 2012 White Paper, EPA did not recommend testing "at least one additional species" other than the western honey bee as the FIFRA SAP advised. EPA wrote that it incorporated guidance from the FIFRA SAP "where such recommendations [could] be immediately implemented," but did not incorporate other recommendations, including the testing of any non-*Apis* bees, because, again, "the science supporting such efforts ha[d] not been sufficiently vetted," according to the agency.[185] Though EPA committed at the time to "consider [the additional recommendations] as the science evolves,"[186] the agency has never taken additional steps to systematically require testing of non-*Apis* pollinator species.

ii. Bee pollinators are not representative of butterflies or moths.

While EPA's pollinator risk assessment guidance documents improperly assume that honey bees are a surrogate for all bee pollinators, those documents do not address the fact that honey bees are even less-suited surrogates for non-bee pollinators like butterflies and moths (the order *Lepidoptera*). Thus, the entire *Lepidoptera* order of important pollinating insects receives zero attention in EPA's pollinator risk assessment—and EPA's requested data on pesticide impacts to honey bees yields no meaningful information about how butterflies and moths will be impacted.

Butterflies and moths are members of the second-largest insect order in the world.[187] The order *Lepidoptera* contains some 157,000 described species, including roughly 750 species of butterflies and 11,000 species of moths in the United States alone.[188] Butterflies are recognized as important indicators of environmental health due in part to their relative ease of identification, sensitivity to environmental change, and short generation time.[189] In addition to their ecological

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[181] *Id.* at 14.

[182] *Id.* at 15.

[183] *Id.* at 14–15.

[184] *Id.* at 15.

[185] 2014 Guidance at 2.

[186] *Id.*

[187] Colorado State University, College of Agricultural Sciences, *Butterflies and Moths*, https://agsci.colostate.edu/agbio/ipm-pests/butterflies-and-moths/ (last visited Nov. 20, 2024).

[188] *See* Richard Mally et al., *Moths and Butterflies on Alien Shores: Global Biogeography of Non-Native Lepidoptera*, 49 J. of Biogeography 1456 (2022); Smithsonian, *BugInfo: Butterflies in the United States*, https://www.si.edu/spotlight/buginfo/butterflyus (last visited Nov. 20, 2024); Smithsonian, *BugInfo: Moths*, https://www.si.edu/spotlight/buginfo/moths (last visited Nov. 20, 2024).

[189] *See* Nora Braak et al., *The Effects of Insecticides on Butterflies – A Review*, 242 Environmental Pollution 507, 508 (2018); Andrew Whitworth et al., *Food for Thought. Rainforest Carrion-feeding*

importance as pollinators, *Lepidoptera* are a critical food source for other wildlife. Caterpillars are a key dietary component for more than 300 species of birds in North America, and birds can require them in great numbers.[190] For example, it takes roughly 6,000 to 9,000 caterpillars to rear a single clutch of Carolina chickadees.[191] In fact, a reduction in caterpillar availability during the breeding season of insectivorous birds has been linked to reduced nestling fitness.[192] Researchers have even observed that terrestrial birds for which insects are an essential food source have declined by 2.9 billion individuals over the last 50 years, while terrestrial birds that do not depend on insects have gained 26.2 million individuals—a 111-fold difference.[193] This suggests that declines in *Lepidoptera* are directly related to documented declines in terrestrial bird abundance.[194]

A growing body of research also shows the essential and irreplaceable nature of butterfly and moth pollination services. A recent study found that butterflies and flies together contribute as much as $120 million annually to cotton production in Texas alone.[195] Butterflies and moths often have broader temporal activity ranges and can provide pollination services at different times of day compared with bees.[196] Some studies have shown that butterflies and moths may be more efficient in transferring pollen for some crops under certain conditions, and even visit spatially and temporally unique flowers that otherwise may go without pollination services.[197] Some butterflies and moths also carry pollen further distances than some bees; this may have important genetic consequences for wild plants.[198]

Lepidoptera life histories and physiologies are highly distinct from those of bees, giving rise to differences in pesticide vulnerability across these taxa. Butterflies and moths have high surface-area-to-volume ratios, which makes them more likely to encounter higher pesticide exposure concentrations in the field than honey bees.[199] *Lepidoptera* may respond to pesticides "dramatically differently" at different life stages—egg, larva (caterpillar), pupa (chrysalis or cocoon), adult—that have no true analogue in honey bee testing.[200] Butterflies and moths also

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Butterflies are More Sensitive Indicators of Disturbance History than Fruit Feeders, 217 Biological Conservation 383 (2018).

[190] *See* Ashley C. Kennedy, *Examining Breeding Bird Diets to Improve Avian Conservation Efforts* (Ph.D. dissertation University of Delaware) xi (2019); Douglas W. Tallamy & W. Gregory Shriver, *Are Declines in Insects and Insectivorous Birds Related?*, 123 Ornithological Applications 2–3 (2021).

[191] Tallamy & Shriver, *supra* note 190, at 2.

[192] *Id.*

[193] *Id.* at 1, 3.

[194] *Id.* at 1–3.

[195] Sarah Cusser et al., *Unexpected Functional Complementarity from Non-bee Pollinators Enhances Cotton Yield*, 314 Agriculture, Ecosystems and Environment 1 (2021).

[196] Romina Rader et al., *Non-bee Insects are Important Contributors to Global Crop Pollination*, 113 PNAS 146, 147 (2016); Max Anderson et al., *Marvellous Moths! Pollen Deposition Rate of Bramble (Rubus futicosus L. agg.) is Greater at Night than Day*, 18 PLoS ONE 1 (2023); *see also* Melanie Hahn & Carsen A. Brühl, *The Secret Pollinators: An Overview of Moth Pollination with a Focus on Europe and North America*, 10 Arthropod-Plant Interactions 21 (2016).

[197] Rader et al., *supra* note 196, at 147; Anderson et al., *supra* note 196, at 1; Hahn & Brühl, *supra* note 196, at 21; Cusser et al., *supra* note 195, at 1.

[198] Rader et al., *supra* note 196, at 147.

[199] *See* Tham C. Hoang et al., *Use of Butterflies as Non-target Insect Test Species and the Acute Toxicity and Hazard of Mosquito Control Insecticides*, 30 Environ. Toxicol. Chem. 997, 1004 (2011).

[200] *Id.*

face exposure pathways not faced by bees. For example, many butterflies engage in "mud puddling" behavior in which they gather around damp or muddy areas to sip on mineral-rich water; this exposes the butterflies to pesticide residues from direct application, drift, or runoff.[201] Butterflies also collect pesticide-contaminated honey dew from plant stems and leaves.[202] Finally, butterflies and moths may experience greater adverse effects from some pesticide exposures than other insect taxa. For example, many insect growth regulator (IGR) insecticides are specifically designed to target moths, and they may be less harmful to bee species by comparison.[203] But because IGRs are not specialized to target only moth *pests*, they adversely impact non-target (i.e., benign) moth species in equal measure.

Lepidoptera pesticide responses can be highly species-specific, underscoring the importance of testing as many species as possible.[204] For example, in one study, researchers found that White peacock butterfly (*Anartia jatrophae*) caterpillar larvae were 57 times more sensitive to a tested pesticide than Painted lady butterfly (*Vanessa cardui*) caterpillar larvae—a difference that could not have been solely explained by difference in larval size.[205] Even within a given *Lepidoptera* species, pesticide response is highly dependent on the life stage under examination, and patterns are hard to predict: in one study, for some pesticides and species, larvae became more sensitive over time; for others, the reverse was true.[206] In another recent study on monarch butterflies, second instar caterpillars (caterpillars in their first of five developmental stages) were roughly 100 times more sensitive to the insecticide chlorantraniliprole than fifth instar caterpillars (caterpillars in their final pre-chrysalis stage).[207]

Butterflies and moths are harmed by pesticides in other less direct—but no less devastating—ways: some species deposit their eggs on one plant species, to the exclusion of others, such that the herbicide-induced extirpation of these host plants has major population-level

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[201] *See* Kunal Ankola et al., *Ecological Significance of Puddling as a Behavioural Phenomenon in the Life History of Butterfly Papilio polytes Linn. (Lepidoptera: Papilionidae)*, 24 J. of Asia-Pacific Entomology 1, 1–2 (2021); Braak et al., *supra* note 189, at 508.

[202] *See* Braak et al., *supra* note 189, at 508.

[203] *Compare, e.g.*, Kees van Frankenhuyzen & Jacques Régnière, *Multiple effects of tebufenozide on the survival and performance of the spruce budworm* (Lepidoptera: Tortricidae), 149 Can. Entomol. 227 (2016) ("Tebufenozide [insect growth regulator insecticide] is selectively toxic to larval Lepidoptera . . . .") *and* Guy Smagghe & Danny Degheele, *Action of a Novel Nonsteroidal Ecdysteroid Mimic, Tebufenozide (RH-5992), on Insects of Different Orders*, 44 Pestic. Sci. 85, 85–86 (1994) *with* U.S. EPA, *Review of Field Pollinator Study with Tebufenozide* 2 (July 7, 2014), https://www.regulations.gov/document/EPA-HQ-OPP-2008-0824-0030 ("[T]he acute toxicity studies of honeybees indicate that the technical grade tebufenozide is practically non-toxic to young adult honey bees on an acute contact exposure basis . . . ."); *see also* Braak et al., *supra* note 189, at 507–08, 513.

[204] Braak et al., *supra* note 189, at 511–13; *see also* Thomas James Wood & Dave Goulson, *The Environmental Risks of Neonicotinoid Pesticides: A Review of the Evidence Post 2013*, 24 Environ. Sci. Pollut. Res. 17310 (2017).

[205] *See* Braak et al., *supra* note 189, at 512 (discussing Hoang et al., *supra* note 199).

[206] *See* Peter J. Eliazar & Thomas C. Emmel, *Adverse Impacts to Non-target Insects*, *in Mosquito Control Pesticides: Ecological Impacts and Management Alternatives* 17–19 (Thomas C. Emmel & John C. Tucker eds., Scientific Publishers, Inc., 1991).

[207] Naranjana Krishnan, *Assessing the Risk of Insecticide Exposures on Monarch Butterflies* (Ph.D. dissertation Iowa State University) 30 (Jan. 1, 2021); *see also* Karen Oberhauser and Kristen Kuda, *A Field Guide to Monarch Caterpillars* (Danaus plexippus) 4 (1997), https://mjv.nyc3.cdn.digitaloceanspaces.com/documents/field-guide-monarch-caterpillars-danaus-plexippus.pdf.

impacts on the dependent *Lepidoptera* species. Such has been the case with milkweed (*Asclepias* spp.), the sole host plant to the monarch butterfly (*Danaus plexippus*).[208] The rapid adoption of herbicide-tolerant genetically modified corn and soybeans gave rise to the ubiquitous use of the herbicide glyphosate, which effectively eliminated milkweed in and around agricultural fields in the Midwest.[209] This has contributed to sharp declines of monarch populations, which rely on milkweed for summer breeding habitat.[210]

In sum, *Lepidoptera* are critical pollinators alongside bees and other insects. Yet non-target butterflies and moths face significant risks from pesticide exposures—and these risks are wholly ignored in EPA's non-binding guidance documents, let alone the older codified pollinator data requirements.

D. EPA is lagging behind European authorities in assessing pesticide risks based on current scientific research.

EPA is not only failing to take necessary steps to address unreasonable adverse effects to insect pollinators from pesticide use, but it is also falling behind international peer organizations in doing so. In 2012, EPA declined to adopt many of the FIFRA SAP's recommendations concerning the 2012 White Paper because "the science supporting" the recommendations had "not been sufficiently vetted,"[211] but EPA committed to "consider[ing] [the additional recommendations] as the science evolves."[212] The work of the European Food Safety Authority ("EFSA") and its partner agencies shows that the science, has, in fact, evolved, and that the FIFRA SAP's 2012 recommendations are not only now practicable, but essential for EPA's pollinator risk assessment.

EFSA, the agency responsible for pesticide regulation in the European Union, has taken concrete steps to align its pollinator risk assessment with advances in scientific research, which shows that honey bees are a poor surrogate for solitary bees and bumble bees[213] as well as for butterflies and moths.[214] EFSA has announced a goal that, by 2030, the agency's pesticide environmental risk assessment "will be further advanced to better protect insect pollinators (including wild and managed pollinators), their diversity, ecological functions and ecosystem services they provide, including pollination"—a goal motivated by "the necessity to reverse [the]

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[208] *See* Bernadette M. Mach, *Target and Non-target Effects of Insecticide Use During Ornamental Milkweed Production*, 53 Environmental Entomology 648 (2024).

[209] John Pleasants et al., *A Comparison of Summer, Fall and Winter Estimates of Monarch Population Size Before and After Milkweed Eradication from Crop Fields in North America*, 17 Insect Conservation and Diversity 51, 52 (2023).

[210] *Id.*; *see also* Mach, *supra* note 208, at 2; Vera Krischik et al., *Soil-Applied Imidacloprid Translocates to Ornamental Flowers and Reduces Survival of Adult* Coleomegilla maculata, Harmonia axyridis, *and* Hippodamia convergens *Lady Beetles, and* Larval Danaus plexippus *and* Vanessa cardui *Butterflies*, 10 PLoS ONE 1 (2015); Jacob R. Pecenka & Jonathan G. Lundgren, *Non-target Effects of Clothianidin on Monarch Butterflies*, 102 Sci. Nat. 1 (2015).

[211] 2014 Guidance at 2.

[212] *Id.*

[213] *See* Shahmohamadloo et al., *supra* note 162, at 1; Schmolke et al., *supra* note 162, at 1; Banks et al., *supra* note 162, at 336; Franklin & Raine, *supra* note 162, at 1373; Raine & Rundlöf, *supra* note 162, at 551; Siviter et al., *supra* note 162, at 2586; Witwicka et al., *supra* note 162, at 1038–39.

[214] *See* Braak et al., *supra* note 189, at 507, 508; Hoang et al., *supra* note 199, at 997; Eliazar & Emmel, *supra* note 206, at 17–19.

decline [of pollinators] and activate all levers to protect biodiversity and particularly vulnerable ecosystems."[215]

To that end, EFSA has developed a risk assessment framework for the testing of pesticide impacts on solitary bees and bumble bees.[216] Under this framework, pesticide registrants must submit data on acute oral and contact toxicity for solitary and bumble bees,[217] and higher-tier testing for solitary and bumble bees where warranted and possible.[218] EFSA also has initiated an administrative process to advance the environmental risk assessment for butterflies and moths, among other insect pollinators.[219] Pursuant to a multi-year framework, EFSA has set a goal of filling knowledge gaps regarding the "biological and ecological traits that influence the vulnerability" of *Lepidoptera* and other pollinator groups to pesticides.[220] Notably, some international pesticide manufacturers are already complying with EFSA's new data requirements for insect pollinators beyond honey bees—highlighting the practicability of those same registrants submitting more robust data for pesticide registration to EPA.[221]

EPA has elsewhere declined to adopt petitioned-for changes to its FIFRA pollinator risk assessment on the basis that its current practices are "consistent with EPA's international regulatory counterparts."[222] Even if this were true in other contexts, it is not true in the case of consideration of pesticide impacts to solitary bees, bumble bees, butterflies, and moths. Given FIFRA's explicit command, our nation should not lag behind our European counterparts in taking action to ensure against unreasonable adverse effects to the environment from widespread pesticide use. EPA should look to EFSA's example of what is possible and essential to protect insect pollinators from pesticides.

IV. EPA must swiftly take corrective action to fill the gaps in its pollinator data requirements.

As the foregoing demonstrates, the time has come for EPA to revise and modernize its pollinator risk assessment. Specifically, in order to avoid registering pesticides that have "unreasonable adverse effects on the environment" in contravention of FIFRA, EPA must require

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[215] *See* European Food Safety Authority, *Theme (Concept) Paper – Advancing the Environmental Risk Assessment of Chemicals to Better Protect Insect Pollinators (IPol-ERA)* 4 (2022), https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2022.e200505.

[216] *See* European Food Safety Authority, *Revised Guidance on the Risk Assessment of Plant Protection Products on Bees (*Apis mellifera, Bombus *spp. and Solitary Bees)* 3 (2023), https://www.efsa.europa.eu/en/efsajournal/pub/7989 [hereinafter "EFSA Revised Guidance"].

[217] *See* EFSA Revised Guidance at 53–54.

[218] *See* EFSA Revised Guidance at 88–90.

[219] *See* James Henty Williams et al., European Food Safety Authority, *Roadmap for Action on the Environmental Risk Assessment of Chemicals for Insect Pollinators (IPol-ERA)* (2023).

[220] *Id.* at 49, 65.

[221] *See, e.g.*, EFSA, *Conclusion on the Peer Review of the Pesticide Risk Assessment for the Active Substance Clothianidin in Light of Confirmatory Data Submitted*, 14 EFSA Journal 9–10 (2016) (describing honey bee, bumble bee, and solitary bee data submitted by applicants Bayer Crop Science and Sumitomo Chemical Agro Europe).

[222] *See* U.S. EPA, *EPA Response to the 2017 Petition from the Center for Food Safety and Others Relating to the Whole Formulations Testing and Mixtures for Conventional Pesticides* 26 (Sept. 28, 2023); *id.* at 22 (explaining that the pesticide testing requirements in question are "generally consistent with other international regulatory authorities, such as those in Canada and Europe").

pesticide registrants to submit the below categories of pollinator data pursuant to registration and registration review. Some of the below categories of data are requested of registrants from time to time pursuant to the 2014 Guidance, 2016 Process Guidance, or 2016 Testing Guidance, but they are not reliably collected in every registration process because they are not codified at 40 C.F.R. § 158.630(d). Other categories of data EPA has never endeavored to collect. All of the below data, however, are essential to a comprehensive pollinator risk assessment, as FIFRA requires.

A. EPA must mandate testing of acute oral toxicity to adult honey bees, acute oral toxicity to larval honey bees, chronic oral toxicity to adult honey bees, and chronic oral toxicity to larval honey bees.

EPA must update its pollinator data requirements at 40 C.F.R. § 158.630(d) to unconditionally require pesticide registrants to submit testing data for acute oral toxicity to adult honey bees, acute oral toxicity to larval honey bees, chronic oral toxicity to adult honey bees, and chronic oral toxicity to larval honey bees. These four categories of testing data are not currently required as a matter of course—unconditionally or conditionally, for any use patterns or test substances—yet, without them, EPA cannot comply with its statutory duty to ensure that pesticides do not cause unreasonable adverse effects on the environment.

The need to codify EPA's existing guidance is supported by EPA's own stated reasoning. EPA has recognized the importance of these categories of data to the pollinator risk assessment for pesticide registration and registration review since at least 2012,[223] and the FIFRA SAP has concurred in EPA's determinations that these four categories of data are essential.[224] Explaining the utility of honey bee adult acute oral toxicity data, EPA has stated that "[c]urrently available toxicity studies do not address possible effects of oral exposure on adult terrestrial insect survival," and "[b]ecause of the potential for pollen and nectar to be contaminated with pesticide residues, and subsequently brought back to the hive, it is important to determine the acute oral toxicity of [a] compound to adult honey bees and other insect pollinators."[225] Similarly, EPA has justified the need for honey bee larvae acute oral toxicity data on the basis that "[a]vailable toxicity studies do not address possible effects on brood (larvae and pupae) survival/development," and "[b]ecause of the potential for pollen and nectar to be contaminated with pesticide residues, and subsequently brought back to the hive, it is important to determine the acute toxicity of this compound to bee brood."[226]

EPA has also explained the need for the two categories of chronic exposure data in the pollinator risk assessment. Describing the specific need for honey bee adult chronic oral toxicity data, EPA has stated that "[c]urrently available toxicity studies do not address possible lethal and sublethal effects of chronic oral exposure on adult terrestrial invertebrates and will assist in determining whether the sensitivity of adult bees differs from that of earlier life stages."[227] Similarly, EPA has stated that honey bee larvae chronic oral toxicity data is needed because "[a]vailable toxicity studies do not address possible chronic effects on brood (larvae and pupae)

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[223] *See* 2012 White Paper at 104–12.

[224] FIFRA SAP Comments on 2012 White Paper at 24–30.

[225] 2016 Testing Guidance at 27.

[226] *Id.* at 28.

[227] *Id.* at 29.

survival," and "[i]t is important to determine chronic larval/pupal toxicity and whether adult emergence is adversely affected."[228]

EPA's aborted 2015 rulemaking would have codified these data requirements as Tier I submissions in 40 C.F.R. § 158.630(d).[229] This means the finalized rule would have required pesticide registrants to submit honey bee adult acute oral toxicity data, honey bee larvae acute oral toxicity data, honey bee adult chronic oral toxicity data, and honey bee larvae chronic oral toxicity data for terrestrial, forestry, and outdoor residential uses for a given technical-grade active ingredient and the typical end-use product.[230] Yet because EPA abandoned that rulemaking without explanation, these four categories of required data were never codified.

As discussed, EPA does periodically use its data call-in authority under FIFRA to request these data of registrants,[231] consistent with the 2014 Guidance,[232] 2016 Testing Guidance,[233] and 2016 Process Guidance.[234] But this approach yields data gaps and inconsistencies, including EPA's failure to collect these data for certain registration review decisions;[235] the lack of standardized testing protocols;[236] and delays in the registration and registration review processes.[237]

EPA must therefore initiate a rulemaking to update its pollinator data requirements at 40 C.F.R. § 158.630(d) by unconditionally requiring pesticide registrants to submit testing data for acute oral toxicity to adult honey bees, acute oral toxicity to larval honey bees, chronic oral toxicity to adult honey bees, and chronic oral toxicity to larval honey bees. As EPA has acknowledged, these data are essential to the pollinator risk assessment under FIFRA. They must be treated as such.

B. EPA must mandate pesticide testing for bumble bees and solitary bees.

In addition, EPA must require pesticide registrants to submit testing data for bumble bees and solitary bees. As discussed above, even as of twelve years ago, the FIFRA SAP and EPA itself recognized that honey bees are a poor surrogate for bumble and solitary bees, yet EPA continued to defend the practice.[238] EPA's defenses of this practice no longer hold water, if they ever did.

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[228] *Id.* at 30.

[229] 2016 Process Guidance at 7–8.

[230] *See* U.S. EPA, Office of Pesticide Programs, *Current Thinking for Implementing New Bee Exposure and Effects Testing and Schedule for Neonicotinoid Risk Assessments* 4 (May 18, 2016), https://www.epa.gov/sites/default/files/2016-05/documents/session-4-pollinator-protection-activities-part_i.pdf.

[231] 7 U.S.C. § 136a(c)(2)(B); 2016 Process Guidance at 8, 10.

[232] *See* 2014 Guidance at 19–20.

[233] *See* 2016 Testing Guidance at 18.

[234] *See* 2016 Process Guidance at 17–18.

[235] *See* Imidacloprid 2020 Bee Risk Assessment at 146.

[236] *See, e.g.*, Imidacloprid 2020 Bee Risk Assessment at 147 (describing a registrant-submitted study of honey bee larvae chronic oral toxicity pursuant to test protocol recommendations of Aupinel et al. (2009) as opposed to OECD test guidelines).

[237] 2016 Process Guidance at 5.

[238] *See supra* section III.C.i.

Scientific developments since 2012 have only served to underscore the significant limitations of the use of honey bees as a surrogate for all bees.[239] A recent meta-analysis of western honey bee and wild bee exposures to neonicotinoids showed that neonicotinoid sensitivity—captured by the median lethal dose—varies between bees by up to six orders of magnitude.[240] This meta-analysis shows that some of the very pesticides EPA has registered and re-registered—on the basis of the ostensible appropriateness of using honey bees as a surrogate for all bees—yield much lower LD_{50} values (in other words, higher toxicity values) for several genera of non-*Apis* bees.[241] In another systematic review of pesticide impacts on *Apis* and non-*Apis* bee species, researchers found that non-*Apis* bee species were more sensitive to pesticides in over one third of cases, and in 5 percent of cases non-*Apis* bee species were *ten times* more sensitive to pesticides than *Apis* species.[242] Scientists have further expanded on the research evidencing the reasons solitary and bumble bees are differently susceptible to pesticide impacts compared to honey bees.[243] It has thus become abundantly clear to scientists that honey bee pesticide responses cannot be extrapolated to pesticide responses among solitary or bumble bees.

Even accepting as true EPA's contention that testing methods for non-*Apis* bees were not "sufficiently vetted" to be used in the quantitative risk assessment as of a decade ago,[244] the agency can no longer credibly make this claim. In recognition of the inadequacy of treating honey bees as a surrogate for all bees, as well as the importance of non-*Apis* pollinators, EFSA has developed a risk assessment framework for the testing of pesticide impacts on solitary bees and bumble bees.[245] Under this framework, pesticide registrants are asked to submit data on acute oral and contact toxicity for solitary and bumble bees,[246] and higher-tier testing for solitary and bumble bees where warranted and possible.[247] The OECD finalized protocols for bumble bee acute contact and acute oral toxicity tests seven years ago,[248] and registrants are encouraged to

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[239] *See* Shahmohamadloo et al., *supra* note 162, at 1; Schmolke et al., *supra* note 162, at 1; Banks et al., *supra* note 162, at 336; Franklin & Raine, *supra* note 162, at 1373; Raine & Rundlöf, *supra* note 162, at 551; Siviter et al., *supra* note 162, at 2586; Witwicka et al., *supra* note 162, at 1038–39.

[240] Shahmohamadloo et al., *supra* note 162, at 1; *see also* Schmolke et al., *supra* note 162, at 1; Biddinger et al., *supra* note 164, at 3; Rundlöf et al., *supra* note 164, at 77; Hardstone & Scott, *supra* note 164, at 1171; Cresswell et al., *supra* note 164, at 365.

[241] Shahmohamadloo et al., *supra* note 162, at 4–5.

[242] Arena & Sgolastra, *supra* note 165, at 328; *see also* Sampson et al., *supra* note 165, at 1.

[243] *See* Main et al., *supra* note 168; Chan & Raine, *supra* note 168; Siviter et al., *supra* note 168, at 1; Sánchez-Bayo, *supra* note 169, at 806; Franklin & Raine, *supra* note 162; Siviter et al., *supra* note 171, at 1299.

[244] *See* 2012 White Paper at 5; 2014 Guidance at 2.

[245] *See* EFSA Revised Guidance.

[246] *See id.* at 53–54.

[247] *See id.* at 88–90.

[248] *See* Organization for Economic Co-Operation and Development, *Test No. 246: Bumblebee, Acute Contact Toxicity Test* (Oct. 9, 2017), https://www.oecd.org/env/ehs/testing/test-no-246-bumblebee-acute-contact-toxicity-test-9789264284104-en.htm; Organization for Economic Co-Operation and Development, *Test No. 247: Bumblebee, Acute Oral Toxicity Test* (Oct. 9, 2017), https://www.oecd.org/env/ehs/testing/test-no-247-bumblebee-acute-oral-toxicity-test-9789264284128-en.htm.

follow these testing protocols.[249] EFSA is currently implementing plans to develop its non-*Apis* risk assessment even further.[250]

EPA has also claimed that screening-level risk assessments based on pesticide effects on individual honey bees were likely to be "protective" of non-*Apis* bees. EPA made such an argument in it its 2012 White Paper and 2014 Guidance.[251] And, more recently, in the case of several 2020 neonicotinoid registration reviews, EPA claimed that using honey bees as a surrogate for other bee species was appropriate because individual *Apis* and non-*Apis* bees are similarly sensitive to those insecticides, and because non-*Apis* bees have similar—or even lower—levels of exposure to those insecticides as *Apis* bees.[252] These findings directly contradict independent scientific findings—available at the time—that non-*Apis* bees *are* more sensitive to the given pesticides than *Apis* bees and face additional pesticide exposure routes not faced by *Apis* bees.[253] For example, EPA had access to the meta-analysis that showed that non-*Apis* bee species are more sensitive to pesticides in over one third of cases, and in 5 percent of cases non-*Apis* bee species were ten times more sensitive to pesticides than *Apis* species,[254] and to the studies showing why honey bee pesticide responses cannot be extrapolated to solitary and bumble bees.[255] Yet EPA did not meaningfully grapple with these contradictions or otherwise require registrants to submit more data on the non-*Apis* bees' sensitivities to the pesticides in

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[249] *See* EFSA Revised Guidance at 54–55.

[250] *See* Williams et al., *supra* note 219, at 58–72.

[251] 2012 White Paper at 158; 2014 Guidance at 14.

[252] *See, e.g.*, Imidacloprid 2020 Bee Risk Assessment at 25–26 ("Comparisons of . . . acute toxicity data for non-*Apis* species, including bumble bees, indicates that honey bees are similarly sensitive to imidacloprid compared to other non-*Apis* bees which have been tested. . . . . [O]ral exposure of honey bees is similar to (or protective of) oral exposure of other bee species."); U.S. EPA, *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam* 29 (Jan. 14, 2020), https://www.regulations.gov/document/EPA-HQ-OPP-2011-0865-1164 (similar); *see also* U.S. EPA, *Fluindapyr: Section 3 New Chemical Ecological Risk Assessment* 59–60 (June 30, 2020), https://www.regulations.gov/document/EPA-HQ-OPP-2018-0551-0008 ("[N]on-*Apis* bees are not more acutely sensitive to fluindapyr compared to the honey bee . . . . [T]he lack of acute risks found for honey bees is considered a reasonable surrogate for non-*Apis* bees.").

[253] *See* Arena & Sgolastra, *supra* note 165, at 328; Biddinger et al., *supra* note 164, at 3; Rundlöf et al., *supra* note 164, at 77; Hardstone & Scott, *supra* note 164, at 1171; Cresswell et al., *supra* note 164, at 365; European Food Safety Authority Panel on Plant Protection Products and their Residues, *Scientific Opinion on the Science Behind the Development of a Risk Assessment of Plant Protection Products on Bees* (Apis mellifera, bombus spp., *and solitary bees*), 10 EFSA Journal 1 (2012); Angela E. Gradish et al., Comparison of Pesticide Exposure in Honey Bees and Bumble Bees: Implications for Risk Assessments, 48 Environmental Entomology 12–21 (2019); Michelle L. Hladik et al., *Exposure of Native Bees Foraging in an Agricultural Landscape to Current-use Pesticides*, 542 Science of the Total Environment 469 (2016); Natalie K. Boyle et al, *Workshop on Pesticide Exposure Assessment Paradigm for Non-Apis Bees: Foundation and Summaries*, 48 Environmental Entomology 4 (2019).

[254] *See* Arena & Sgolastra, *supra* note 165, at 324, 328.

[255] *See id.*; Biddinger et al., *supra* note 164, at 3; Rundlöf et al., *supra* note 164, at 77; Hardstone & Scott, *supra* note 164, at 1171; Cresswell et al., *supra* note 164, at 365.

question.[256] EPA's focus on only *Apis* bees is even less justified today, given scientific evidence published since the 2020 reviews.[257]

EPA's remaining defenses of its use of honey bees as surrogates for other bees fare no better. EPA suggests that it is reasonable to test only honey bees because they are "the most important commercial pollinators."[258] But this overlooks the fact that non-*Apis* bees are significant purveyors of pollination services in their own right[259]—and, in fact, non-*Apis* bees are more efficient pollinators of whole classes of crops than their *Apis* counterparts.[260]

Moreover, while EPA's duty to ensure that pesticides do not pose "unreasonable adverse effects on the environment" incorporates an obligation to consider the "economic . . . benefits" of a given pesticide,[261] the duty to avoid "unreasonable adverse effects on the environment" obligates EPA to consider "environmental" and "social" costs of the use of the pesticide as well.[262] Indeed, the value of pollinators is incalculable; because the vast majority of the world's plants depend on animal pollination,[263] pollinators are the metaphorical glue holding the world's ecosystems together. Congress made clear in its passage of FIFRA that "the environment" was to include not only the most commercially important species, but the natural world as a whole.[264] This means that EPA must fully evaluate pesticide impacts to non-*Apis* bees regardless of their commercial importance.

EPA has pointed to practicalities in mandating testing of only honey bees, explaining that "the husbandry and life cycle of the species . . . is well known and test protocols are available."[265] Yet in recent years, non-*Apis* bees have been increasingly subject to laboratory studies, and test protocols for a number of non-*Apis* bee species—including *Bombus terrestris*, *Bombus impatiens*, *Osmia lignaria*, and *Osmia bicornis*—have been developed and are widely

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[256] EPA purported to consider these studies pursuant to its open literature review, but the agency afforded little weight to the studies' findings due to its hyper-narrow open literature review criteria. *See* U.S. EPA, *Evaluation Guidelines for Ecological Toxicity Data in the Open Literature*, https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/evaluation-guidelines-ecological-toxicity-data-open (last visited Nov. 22, 2024).

[257] *See, e.g.*, Shahmohamadloo et al., *supra* note 162; Schmolke et al., *supra* note 162; Raine & Rundlöf, *supra* note 162; Witwicka et al., *supra* note 162; Sampson et al., *supra* note 165; Main et al., *supra* note 168; Chan & Raine, *supra* note 168; Siviter et al., *supra* note 171; Siviter et al., *supra* note 162; Siviter et al., *supra* note 168.

[258] 2014 Guidance at 14.

[259] *See* IPBES Pollinator Report at xx, xxxiii.

[260] Wilson & Carril, *supra* note 140, at 163.

[261] *See* 7 U.S.C. § 136a(c)(5) ("[EPA] shall register a pesticide if [it] determines that . . . it will perform its intended function without unreasonable adverse effects on the environment . . . ."); *id.* § 136(bb) (defining "unreasonable adverse effects on the environment" in pertinent part as "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide").

[262] *See id.* §§ 136a(c)(5), 136(bb).

[263] *See* Alexandre R. Zuntini et al., *Phylogenomics and the Rise of the Angiosperms*, 629 Nature 843 (2024) (citing Rafaël Govaerts et al., *The World Checklist of Vascular Plants, a Continuously Updated Resource for Exploring Global Plant Diversity* 1, 215 Sci. Data (2021)); Ze-Yu Tong et al., *New Calculations Indicate that 90% of Flowering Plant Species are Animal-pollinated*, 10 National Science Review 1 (2023); Jeff Ollerton et al., *How Many Flowering Plants are Pollinated by Animals?*, 120 Oikos 321 (2011).

[264] *See* S. Rep. No. 92-838, at 10 (1972).

[265] 2014 Guidance at 2.

used.[266] The body of information about the "husbandry and life cycles" and other characteristics of non-*Apis* bees has grown in turn.[267] And, as noted, international pesticide manufacturers are already complying with EFSA's new data requirements for insect pollinators beyond honey bees.[268] Therefore, it is not reasonable for EPA to suggest that testing of non-*Apis* bees is impracticable.

Indeed, there is no reasonable excuse for EPA's failure to mandate testing of non-*Apis* bee species. Ever cognizant of the "limitations" of using honey bees as a surrogate for all bees, EPA offered in 2014 that it may consider pesticide impacts on non-*Apis* bees as the "science evolves" in the future.[269] The science has, in fact, evolved. EPA must require pesticide registrants to submit testing data for non-*Apis* bee taxa to curb ongoing and profound ecological harms.

C. EPA must mandate pesticide testing for butterflies and moths.

In addition to expanding its risk assessment for bee species, EPA must mandate the submission of toxicity and exposure data for butterflies and moths at the individual and population levels in the pesticide registration process. Such data submission requirements are essential to ensure EPA's compliance with its FIFRA obligation to avoid registering pesticides that have unreasonable adverse effects on the environment.

Significant new research shows that butterflies and moths are in steep decline in the United States and globally.[270] In fact, butterflies and moths provide the "deepest historical lens to examine the phenomenon of global insect decline," as humans have collected *Lepidoptera* specimens for hundreds of years.[271] While *Lepidoptera* face many stressors around the world, pesticides are a significant causal factor in these declines.[272] A recent study even found that insecticides are more strongly associated with the decline of butterfly species richness and

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[266] *See, e.g.*, Organization for Economic Co-Operation and Development, *Test No. 246: Bumblebee, Acute Contact Toxicity Test* (Oct. 9, 2017), https://www.oecd.org/env/ehs/testing/test-no-246-bumblebee-acute-contact-toxicity-test-9789264284104-en.htm; Piotr Medrzycki et al., *Improved Protocols for Testing Agrochemicals in Bees* (2021); Ivo Roessink et al., *A Method for a Solitary Bee (*Osmia *sp.) First Tier Acute Contact and Oral Laboratory Test: An Update*, 13th international symposium of the ICP-PR Bee Protection Group (Oct. 18–20, 2017); Maxime Eeraerts et al., *Recommendations for Standardized Oral Toxicity Test Protocols for Larvae of Solitary Bees,* Osmia *spp*., 51 Apidologie 48 (2020).

[267] *See* Anke C. Dietzsch & Tobias Jütte, *Non-Apis Bees as Model Organisms in Laboratory, Semi-field and Field Experiments*, 72 Journal für Kulturpflanzen 162 (2020).

[268] *See supra* note 221 and accompanying text.

[269] 2014 Guidance at 2.

[270] Jan Christian Habel et al., *Long-term Large-scale Decline in Relative Abundances of Butterfly and Burnet Moth Species Across South-western Germany*, 9 Scientific Reports 1 (2019); Tom Brereton et al., *Trend Notes – Scottish Moths* (2019), https://www.nature.scot/doc/trend-notes-scottish-moths; David L. Wagner et al., *A Window to the World of Global Insect Declines: Moth Biodiversity Trends are Complex and Heterogeneous*, 118 PNAS 1 (2021); Braeden Van Deynze et al., *Insecticides, More than Herbicides, Land Use, and Climate, are Associated with Declines in Butterfly Species Richness and Abundance in the American Midwest*, 19 PLoS One 1 (2024); Dan Blumgart et al., *Moth Declines are Most Severe in Broadleaf Woodlands Despite a Net Gain in Habitat Availability*, 15 Insect Conservation and Diversity 496 (2022).

[271] Wagner et al., *supra* note 270, at 1.

[272] *Id.*; Van Deynze et al., *supra* note 270, at 1.

abundance in the Midwest than any other factor.[273] The study reported, for example, that insecticides contributed to a 33 percent decline in monarch butterfly abundance between 1998 and 2014.[274]

In EPA's pollinator risk assessment, honey bees are a poor surrogate for solitary and bumble bees for reasons already discussed—and they are an even worse surrogate for non-bee species such as butterflies and moths. Because butterflies and moths feature entirely different physiologies, life cycles, and behavioral patterns than bees, there is no scientifically defensible basis for the use of honey bees as surrogates for butterflies and moths in the pollinator risk assessment. Moreover, researchers have already found—and EPA itself admits[275]—that butterflies and moths may experience more significant adverse impacts from pesticides than bees in some instances, such as in the case of insect growth regulators—a class of insecticides specifically designed to target moth pests, and which may have milder impacts on honey bees.[276] Butterflies and moths also face exposure pathways not faced by bees, such as through mud puddling behavior in pesticide-contaminated soil water, and the collection of pesticide-contaminated honey dew from plant trunks and leaves.[277] These *Lepidoptera* exposure pathways and overall different sensitivities to pesticides are wholly absent from EPA's current pollinator risk assessment.

EPA does not purport to analyze pesticide impacts on non-target *Lepidoptera* pursuant to pesticide registration decisions. EPA's analysis of such species is limited to its consideration of pesticide impacts on endangered and threatened butterfly and moth species, such as through the agency's Vulnerable Species Action Plan,[278] Insecticide Strategy,[279] and Risk Management Approach to Identifying Options for Protecting the Monarch Butterfly.[280] These initiatives, while important, do not suffice to protect the many not-yet-listed but imperiled butterfly and moth species from pesticide exposures. EPA itself admits in its Draft Insecticide Strategy that "some groups of listed invertebrates may differ in their sensitivity to a given insecticide compared to other invertebrate groups," and that these differences are "particularly impactful if an insecticide's mode of action . . . targets certain groups of invertebrates,"[281] such as in the case of insect growth regulators, many of which target *Lepidoptera*.[282] EPA further admits that its development of mitigations that might reflect these inter-species differences in pesticide sensitivity is "limited by the available data,"[283] highlighting the need for EPA to collect *Lepidoptera*-specific testing data so that meaningful regulatory responses can follow.[284]

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[273] Van Deynze et al., *supra* note 270, at 1.

[274] *Id.* at 5, 10.

[275] *See* Draft Insecticide Strategy at 65 ("EPA has data that demonstrate that listed butterflies . . . have much greater sensitivity [to foliar applications of methoxyfenozide, an insect growth regulator] than other listed terrestrial invertebrates (bees, dragonflies . . . .").

[276] *See supra* note 203 and accompanying text.

[277] *See* Ankola et al., supra note 201, at 1, 1–2; Braak et al., *supra* note 189, at 508.

[278] *See* EPA Vulnerable Species Action Plan at 7, 30.

[279] *See* Draft Insecticide Strategy at 4–5, 96.

[280] *See* U.S. EPA, *Risk Management Approach to Identifying Options for Protecting the Monarch Butterfly* (June 23, 2015), https://www.regulations.gov/document/EPA-HQ-OPP-2015-0389-0002.

[281] Draft Insecticide Strategy at 25.

[282] *See* Van Frankenhuyzen & Régnière, *supra* note 203, at 227.

[283] Draft Insecticide Strategy at 25.

[284] FWS has also recently acknowledged that while insecticides "are a threat to monarch [butterfly] populations," the agency is unable to evaluate "the degree or extent" of that risk due to numerous "data

While EPA to date has failed to take steps to fill these data gaps, EFSA is much further along. It has recognized the importance of protecting non-target butterfly and moth species from the adverse impacts of pesticides, as well as the inappropriateness of the use of honey bees as a surrogate for *Lepidoptera* in the pollinator risk assessment. To that end, EFSA has initiated an administrative process to advance the environmental risk assessment for butterflies and moths, among other insect pollinators.[285] Pursuant to a multi-year framework that engages many stakeholders, EFSA intends to fill the remaining knowledge gaps concerning the "biological and ecological traits that influence the vulnerability" of *Lepidoptera* and other pollinator groups to pesticides.[286] Specifically, EFSA has initiated seven projects that will fortify its risk assessment for *Lepidoptera* and other non-bee pollinators. First, EFSA will "identify focal species candidates" to "characteri[z]e vulnerability traits within the main pollinator groups," and perform lab and field tests to "identify the most sensitive and vulnerable traits."[287] Then, EFSA will establish a monitoring scheme to better characterize insect pollinator exposure scenarios,[288] and "expand the range of biological and ecological traits across a range of pollinator taxa" to better understand vulnerability factors.[289] EFSA will subsequently develop protocols for testing and predicting toxicological effects of pesticide mixtures on insect pollinators,[290] and then reevaluate its previously selected focal species "to determine their suitability for pesticide risk assessment in the context of pollinator protection."[291] Finally, EFSA endeavors to "develop a systems-based model" to identify new focal species, with a focus on the development of models for "neglected insect pollinator taxa."[292]

EPA has many available tools to fill the data gaps concerning pesticide impacts on *Lepidoptera* in the United States. EPA should convene a body of objective and qualified scientific experts with a charge to develop a plan to incorporate *Lepidoptera* toxicity and exposure data into the pollinator risk assessment. This could entail engagement of the FIFRA Scientific Advisory Panel, the National Academies of Sciences' National Research Council, and/or another expert body. EPA should also solicit public and diverse stakeholder input through an Advanced Notice of Proposed Rulemaking, meetings of the Pesticide Program Dialogue Committee, ESA-FIFRA NGO Quarterly Meetings, and/or other processes. Finally, EPA could partner with EFSA to leverage the advances in *Lepidoptera* risk assessment research already underway in Europe.

The most important thing is that EPA ultimately requires registrants to submit data on pesticide impacts on butterflies and moths pursuant to pesticide registration and registration

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gaps" for the species, including in testing data specific to monarchs as opposed to other species. *See* U.S. Fish & Wildlife Serv., *Monarch Butterfly* (Danaus plexippus) *Species Status Assessment Report, version 2.3* at 138 (2024), https://www.regulations.gov/document/FWS-R3-ES-2024-0137-0017.

[285] *See* Williams et al., *supra* note 219.

[286] *Id.* at 49, 65.

[287] *Id.* at 65–66 (describing IPOL-FOCAL-SPEC: Focal species selection and testing).

[288] *Id.* at 66–67 (describing IPOL-ERA-EXPOSURE: Pesticide exposure of insect pollinators across landscapes).

[289] *Id.* at 68 (describing CAKE-ERA-TRAIT: Continuing Advancement of Knowledge on focal species and their traits for effective [environmental risk assessment] of pesticides in insect pollinators).

[290] *Id.* at 68–70 (describing TOX-POLL-GUIDE: Develop protocols for laboratory testing and predict toxicological effects of pesticide mixtures on focal insect pollinators).

[291] *Id.* at 70–71 (describing REVISE-ERA: Re-evaluation of focal species for implementation of system-based ERA).

[292] *Id.* at 71–72 (describing POLL-MODEL: Develop systems-based models for new focal species).

review. Given the alarming rates of decline among *Lepidoptera* taxa and their established causal link to pesticide exposures, EPA must examine pesticide impacts to these species to ensure compliance with its statutory obligation under FIFRA.

CONCLUSION

Rachel Carson's *Silent Spring* closed by offering a map toward "the other road" we might take. "The road we have long been traveling is deceptively easy, a smooth superhighway on which we progress with great speed, but at its end lies disaster. The other fork of the road—the one 'less traveled by'—offers our last, our only chance to reach a destination that assures the preservation of our earth."[293]

Today, despite Carson's warning and all of the good work that has been done by EPA and others in response to it, we still find ourselves uncomfortably far along the "smooth superhighway" that leads to "disaster." EPA's pollinator risk assessment is failing to protect thousands of species of wild pollinators from the disastrous impacts of widespread pesticide use. As a result, harms arising from pesticide use are contributing to unprecedented declines in insect pollinator populations. EPA has known of the shortcomings of even its non-binding pollinator testing guidance documents for years, yet the agency has never taken steps to address these shortcomings, or even finalized the codification of non-binding pollinator testing guidance to ensure effective and consistent implementation of the FIFRA registration process.

This petition calls on EPA to take a step down "the other road." EPA's grant of this petition will enable the agency to more effectively ascertain pesticide impacts to a broader variety of species in light of the best available scientific information. Critically, it will also enable EPA to fulfill its obligation under FIFRA to ensure that pesticides do not have "unreasonable adverse effects on the environment" and address the grave threat of a world with too few insect pollinators. EPA should initiate prompt steps to take the petitioned actions.

Respectfully submitted this 17th day of December, 2024,

/s/ Rosemary Malfi, Ph.D.
Director of Conservation Policy
The Xerces Society for
Invertebrate Conservation
Phone: (857) 209-8548
rosemary.malfi@xerces.org

/s/ Emily May
Agricultural Conservation Lead,
Pesticide Program
The Xerces Society for
Invertebrate Conservation
Phone: (240) 645-6605
emily.may@xerces.org

/s/ Sharmeen Morrison
Attorney (*Admitted only in New York*)
Earthjustice
Phone: (415) 217-2005
smorrison@earthjustice.org

Counsel for Petitioner

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[293] Rachel Carson, *Silent Spring* 244 (1962).