

COMMENTS

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The Price of Pesticides: Environmental and Economic Impacts of Using Neonicotinoids in Agriculture

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ABSTRACT

The busy buzzing sounds of honeybee hives were a constant throughout my childhood. I grew up on an almond orchard in central California, where the annual delivery of boxes of honeybee hives signaled the arrival of spring. By early March, each of the almond trees exploded with delicate pink blossoms, indicating they were ready for honeybees to begin the pollination process. Swarms of honeybees worked throughout the early spring, buzzing loudly as they flitted around the orchard and pollinated each tree. As a child, I thought the arrival and departure of honeybees in the orchard was the most natural thing in the world, and their presence seemed like an everlasting symbol of springtime. As an adult, I have realized that the health and wellbeing of honeybees across the world is at stake and taking honeybees for granted could come at a significant price.

INTRODUCTION

Honeybees are among the most prominent and important types of pollinators worldwide, with approximately thirty-five percent of world food crop production depending on honeybees and other pollinators.¹ In the United States, the estimated value of insect pollination to agricultural production is \$16 billion annually, and approximately three-fourths of that value is attributable to honeybees.² The worldwide contribution of honeybees and other pollinators to global crop production for human food is valued at approximately \$190 billion.³ Given the importance of honeybees and other bee species to food production, scientists and farmers have recently expressed concern about a possible “pollinator crisis” occurring over recent

¹ Tjeerd Blacquière et al., *Neonicotinoids in Bees: A Review on Concentrations, Side-Effects and Risk Assessment*, 21 *ECOTOXICOLOGY* 973, 973 (2012), [https://link.springer-com.libproxy.uoregon.edu/content/pdf/10.1007/s10646-012-0863-x.pdf](https://link.springer.com.libproxy.uoregon.edu/content/pdf/10.1007/s10646-012-0863-x.pdf) [<https://perma.cc/GF7V-R37F>].

² RENÉE JOHNSON & M. LYNNE CORN, CONG. RSCH. SERV., R43191, BEE HEALTH: BACKGROUND AND ISSUES FOR CONGRESS 1 (2015).

³ *Id.* at 5.

decades and have raised questions about the role neonicotinoids [neoh-nick-oh-tin-oids] may be playing in this crisis.⁴

One of the biggest threats to honeybee health is the widespread application of neonicotinoids, a class of insecticides that share chemical similarities with nicotine.⁵ First developed in the 1990s, neonicotinoids are a class of pesticides designed to combat issues with insecticide resistance seen in older pesticides.⁶ Neonicotinoids provide long-term protection against insects with chewing and sap-sucking abilities due to their systemic properties, which allow them to enter plants via the roots and incorporate into the treated plant's tissue.⁷ When first introduced commercially, neonicotinoids were viewed as the pesticide of the future because of their low mammalian toxicity, persistence, and systemic action.⁸

Upon their introduction, people believed that neonicotinoids were less toxic to invertebrates than older insecticides; this belief led to their widespread use in agricultural and residential areas.⁹ Recently, scientists have scrutinized neonicotinoids due to their potential negative health implications for nontarget organisms such as honeybees.¹⁰ Because the molecular structures of neonicotinoids closely resemble those in nicotine and initiate physiological responses in insects' central nervous systems, neonicotinoids may make honeybees more susceptible to contracting harmful parasites and viruses, which can lead to the destruction of entire colonies of honeybees.¹¹

⁴ *Id.* at 1.

⁵ See *What Is a Neonicotinoid?*, TEX. A&M AGRILIFE EXTENSION, <https://citybugs.tamu.edu/factsheets/ipm/what-is-a-neonicotinoid/> [<https://perma.cc/A98E-6ZXP>] (last visited Mar. 13, 2022) [hereinafter *What Is a Neonicotinoid*].

⁶ Tawny Simisky, *Tree and Shrub Insecticide Active Ingredients: Alternatives to Neonicotinoids*, UMASS EXTENSION LANDSCAPE, NURSERY AND URB. FORESTRY PROGRAM, <https://ag.umass.edu/landscape/fact-sheets/tree-shrub-insecticide-active-ingredients-alternatives-to-neonicotinoids> [<https://perma.cc/BMA2-67HT>] (last updated Oct. 2018) [hereinafter *Insecticide Active Ingredients*].

⁷ JENNIFER HOPWOOD ET AL., HOW NEONICOTINOIDS CAN KILL BEES 1 (2nd ed. 2016), https://www.xerces.org/sites/default/files/2018-05/16-022_01_XercesSoc_How-Neonicotinoids-Can-Kill-Bees_web.pdf [<https://perma.cc/HR22-2CJK>].

⁸ Simisky, *supra* note 6.

⁹ TRAVIS A. GROUT ET AL., NEONICOTINOID INSECTICIDES IN NEW YORK STATE 21 (Catherine Crosier & Lauren Cody eds., 2020), https://legacy-assets.eenews.net/open_files/assets/2020/07/08/document_gw_15.pdf [<https://perma.cc/8HB7-V5HH>].

¹⁰ *Id.*

¹¹ *Id.* at 50–54 (Active ingredients in neonicotinoids include acetamiprid, clothianidin, dinotefuran, imidacloprid, nitenpyram, thiacloprid, and thiamethoxam.); *What Is a Neonicotinoid*, *supra* note 5.

Some farmers do not believe neonicotinoids are to blame for the troubling decline in honeybee populations. Neonicotinoids are especially popular among many farmers who use them in integrated pest management (IPM) programs.¹² IPM programs allow farmers to selectively control insect pests while ensuring beneficial insects remain available to keep other potential insect pests in check.¹³ The versatility of application and favorable pest control properties of neonicotinoids have contributed to them becoming the most widely used insecticides in IPM systems across the world.¹⁴ Farmers who choose to apply neonicotinoids to their crops acknowledge that, while alternative insecticides or pest control strategies exist for nearly all relevant target pests, switching from neonicotinoids usually entails a direct or indirect cost to users.¹⁵ Additionally, many farmers believe that neonicotinoids are the best option when considering factors such as price, efficacy, safety, and insecticide rotation pattern, among others.¹⁶

The wide-ranging environmental impact, including the honeybee decline, and economic considerations to farmers surrounding the use of neonicotinoids have led to political and administrative controversy. In 2018, the Trump Administration rolled back regulations prohibiting the use of neonicotinoids on wildlife refuges, claiming that neonicotinoids were necessary for “farming practices” in these areas.¹⁷ A year later, under former President Trump’s direction, the Environmental Protection Agency (EPA) issued emergency approval to spray neonicotinoids onto more than sixteen million acres of crops.¹⁸ The

¹² See *The Importance of Neonicotinoids in Integrated Pest Management*, AGINFOMATICS (2014), <https://growingmatters.org/wp-content/uploads/2017/04/infographic-the-importance-of-neonicotinoids-to-integrated-pest-management.pdf> [<https://perma.cc/3BSV-EUBY>] [hereinafter *Integrated Pest Management*].

¹³ *Id.*

¹⁴ See GROUT ET AL., *supra* note 9, at 55.

¹⁵ BRET SHAW & KEN GENSLOW, THE VALUE OF NEONICOTINOIDS IN NORTH AMERICAN AGRICULTURE, AGINFOMATICS 3 (2014), https://aginfomatics.com/uploads/3/4/2/2/34223974/summary_perspectives_listening_sessions.pdf [<https://perma.cc/UP36-Y4VF>] [hereinafter THE VALUE OF NEONICOTINOIDS].

¹⁶ *Id.*

¹⁷ Lisa Spear, *What are Neonicotinoids? Trump Administration Rolls Back Ban on Synthetic Chemical Pesticides*, NEWSWEEK (Aug. 7, 2018, 6:07 PM), <https://www.newsweek.com/neonicotinoids-trump-administration-rolls-back-ban-1061906> [<https://perma.cc/XH6C-T98M>].

¹⁸ Press Release, Ctr. for Biological Diversity, *Trump EPA Used ‘Emergency’ Loophole to Approve Pesticides Toxic to Bees on 16 Million Acres in 2019* (Jan. 2, 2020), <https://biologicaldiversity.org/w/news/press-releases/trump-epa-used-emergency-loophole-to-approve-pesticides-toxic-to-bees-on-16-million-acres-in-2019-2020-01-02/> [<https://perma.cc/W9CL-Z9JR>] [hereinafter *Trump EPA*].

Biden Administration may be taking a different approach to pesticide regulation—a recent ban on another highly controversial insecticide, chlorpyrifos, has led to speculation that bans on neonicotinoids will inevitably follow.¹⁹

Legislation aiming to curb the use of neonicotinoids has cropped up throughout various state legislatures over the past several years. In 2016, Maryland proposed banning the sales of products containing neonicotinoids throughout the state.²⁰ In the same year, the Oregon Senate proposed an almost identical bill.²¹ The Oregon version of the bill intended to ban the sales of insecticides containing neonicotinoids but would have provided exemptions for certified applicators and farmers.²² On the federal level, Oregon Congressman Earl Blumenauer introduced a bill that would have required the EPA to act on neonicotinoids and other insecticides during the 116th Congress in 2019, but the legislation died in committee.²³

Environmental advocates continue to clamor for legislative action to restrict neonicotinoid application, but farmers and other proponents of freedom of choice in agricultural management believe governmental regulation of neonicotinoids remains unnecessary.

The negative environmental consequences outweigh the positive economic benefits that result from the use of neonicotinoids in agriculture. The links between neonicotinoid application and harm to honeybees and the environment are troubling and signal that restricting the use of neonicotinoids is necessary. Moving forward, farmers, scientists, and advocates must come together to create a balance between economic stability and environmental conservation.

This Comment addresses the environmental and economic arguments against the use of neonicotinoids. Part I explains the role

¹⁹ David Frabotta, *U.S. Regulators Nix Chlorpyrifos, Neonicotinoids Are Next*, AGRIBUSINESS GLOB. (Sept. 2, 2021), <https://www.agribusinessglobal.com/agrochemicals/u-s-regulators-nix-chlorpyrifos-neonicotinoids-are-next/> [<https://perma.cc/B3NN-4LDK>].

²⁰ *Maryland Bill Would Ban Products Laced with Neonicotinoids*, NAT'L AGRIC. L. CTR. (Mar. 29, 2016), <https://nationalaglawcenter.org/maryland-bill-would-ban-products-laced-with-neonicotinoids/> [<https://perma.cc/G8EC-P4EQ>].

²¹ S.B. 929, 79th Legis. Assemb., Reg. Sess. (Or. 2017).

²² *Id.*

²³ *Blumenauer, McGovern Introduce Legislation to Save the Bees*, U.S. CONGRESSMAN EARL BLUMENAUER (Jun. 23, 2021), <https://blumenauer.house.gov/media-center/press-releases/blumenauer-mcgovern-introduce-legislation-to-save-the-bees> [<https://perma.cc/E774-5YTF>] [hereinafter *Legislation to Save the Bees*]; see H.R. 1337, 116th Cong. (2019) (legislation did not move out of House Agriculture Subcommittee on Biotechnology, Horticulture, and Research).

neonicotinoids play in the deterioration of honeybee health, including their role in perpetuating recent phenomena such as colony collapse disorder. Part II discusses the opposing viewpoint, highlighting and refuting the arguments for the use of neonicotinoids. Finally, Part III looks to the future by examining the benefits of the legislative and legal responses to neonicotinoids. This Comment concludes that bans on certain types of neonicotinoids are necessary to protect the health and wellbeing of honeybees.

I

THE DIRECT LINK BETWEEN NEONICOTINOIDS AND THE DETERIORATION OF HONEYBEE HEALTH

A. The Rise of Neonicotinoid Use in the United States

The deterioration of honeybee health in the United States can be traced back to pesticide use, particularly the use of neonicotinoids. The industrialization of agriculture in the United States can be traced back to increases in chemical control of pests,²⁴ and it contributed to America becoming one of the world's leading producers of agricultural products. The economic viability of the agriculture industry in the United States has caused farmers to maximize crop production in every way possible, and this often begins with pesticide application.²⁵ When applied properly, pesticides are inherently toxic to some organisms, such as weeds or harmful insects.²⁶

The EPA's failure to adequately regulate neonicotinoids has contributed to honeybee population decline. The EPA is responsible for the regulation of pesticides through registration and labeling requirements, and it is ultimately up to the EPA's discretion whether a pesticide poses an "unreasonable risk to man or the environment."²⁷ By approving and allowing neonicotinoid use, the EPA has failed to adequately consider the pitfalls of these insecticides and has overvalued their benefits in reducing pest pressures.²⁸ There are no indications that the EPA has ever denied a registration of a product containing

²⁴ See *Pesticides – An Overview*, NAT'L AGRIC. L. CTR., <https://nationalaglawcenter.org/overview/pesticides/> [<https://perma.cc/A97A-7RML>] (last visited Apr. 8, 2023).

²⁵ See GROUT ET AL., *supra* note 9, at 141.

²⁶ *Pesticides – An Overview*, *supra* note 24.

²⁷ *Id.*

²⁸ SARAH STEVENS & PETER JENKINS, CTR. FOR FOOD SAFETY, HEAVY COSTS: WEIGHING THE VALUE OF NEONICOTINOID INSECTICIDES IN AGRICULTURE 1 (Mar. 2014), https://www.centerforfoodsafety.org/files/neonic-efficacy_digital_29226.pdf [<https://perma.cc/9AG7-R292>].

neonicotinoids, proving that neonicotinoids' potential benefits outweigh their costs.²⁹

Research has proven that neonicotinoids have played a large role in the rapid honeybee decline. Today, researchers have determined that neonicotinoids have contributed to America's crops becoming forty-eight times more toxic to honeybees than they were twenty-five years ago before neonicotinoid use became commonplace.³⁰ Neonicotinoids are being scrutinized by scientists for their high water solubility, toxicity to pollinators such as honeybees, and potential to persist in the environment after degradation.³¹ The potential for neonicotinoids to persist in ecosystems for years after application leads both susceptible and non-susceptible organisms to feed on neonicotinoids and transmit them between trophic levels.³² Neonicotinoids account for an estimated ninety-two percent of the increased toxicity in agriculture since most of the toxins in neonicotinoids seep into soil and the environment, and their water solubility has led to the contamination of streams, ponds, and wetlands.³³

The versatility of application type in neonicotinoids has led to millions of acres of farmlands as well as public parks, gardens, and backyards being treated with neonicotinoids in the United States, resulting in further harm to the honeybee population.³⁴ Neonicotinoids can be applied as foliar sprays, soil drenches, seed coatings, irrigation, or through direct injection.³⁵ Invertebrates like honeybees can be exposed to neonicotinoids in a variety of ways, most commonly by consuming contaminated nectar or pollen.³⁶ Honeybees are particularly vulnerable to neonicotinoid exposure when those neonicotinoids have been sprayed on flowers or applied through seed coatings, as these

²⁹ *Id.* at 3.

³⁰ Stephen Leahy, *Insect 'Apocalypse' in U.S. Driven by 50x Increase in Toxic Pesticides*, NAT'L GEOGRAPHIC (Aug. 6, 2019), <https://www.nationalgeographic.com/environment/article/insect-apocalypse-under-way-toxic-pesticides-agriculture> [https://perma.cc/GK8W-96KP].

³¹ *Id.*

³² S.D. Frank & J.F. Tooker, *Neonicotinoids Pose Undocumented Threats to Food Webs*, 117 (37) PNAS 22609, 22610–11 (Sept. 15, 2020), <https://www.pnas.org/doi/epdf/10.1073/pnas.2017221117> [https://perma.cc/38JQ-66KP].

³³ Leahy, *supra* note 30.

³⁴ HOPWOOD ET AL., *supra* note 7, at 1.

³⁵ *Id.* at viii, 1.

³⁶ *Id.* at 1.

methods usually contain high concentrations of neonicotinoids that prove toxic to pollinators.³⁷

B. Neonicotinoids and Colony Collapse Disorder

The use of neonicotinoids in areas used for agriculture where honeybees pollinate has given rise to increases in colony collapse disorder (CCD). Beekeepers began noticing higher losses in their colonies in the early 2000s, some of which was attributable to colony collapse disorder, a phenomenon that occurs when many worker bees in a colony disappear and leave behind their queen.³⁸ From April 2020 to April 2021, beekeepers across the United States lost 45.5% of their honeybee colonies.³⁹ Research indicates that this significant drop can be traced back to CCD⁴⁰ and that neonicotinoids can increase a honeybee's susceptibility to viruses and parasites.⁴¹ Neonicotinoid pesticide application has been identified as a possible causative factor in CCD.⁴²

A study from the Harvard School of Public Health points to additional links between neonicotinoids and CCD beyond increased susceptibility to viruses.⁴³ The study found that honeybees in hives exhibiting CCD showed nearly identical pathogen infestation levels, suggesting that neonicotinoids can cause a biological mechanism in honeybees that leads to CCD.⁴⁴ Currently, no definitive link between neonicotinoids and CCD has been established,⁴⁵ and researchers believe that CCD is likely a syndrome caused by many different factors.⁴⁶

³⁷ Tina Smith, *Neonicotinoids, Native Pollinators, and Greenhouse Production*, UMASS EXTENSION 1, <https://ag.umass.edu/sites/ag.umass.edu/files/pdf-doc-ppt/16neonic-pollinatorsgh.pdf> [<https://perma.cc/HFJ3-LY46>] (last visited Mar. 12, 2022).

³⁸ Allison LaSorda, *In-Hive Sensors Could Help Ailing Bee Colonies*, SCI. AM. (Aug. 31, 2021), <https://www.scientificamerican.com/article/in-hive-sensors-could-help-ailing-bee-colonies/> [<https://perma.cc/2P2P-VKTU>]; see HOPWOOD ET AL., *supra* note 7, at 26.

³⁹ LaSorda, *supra* note 38.

⁴⁰ *Id.*

⁴¹ See HOPWOOD ET AL., *supra* note 7, at viii.

⁴² *Id.*

⁴³ Press Release, Marge Dwyer, Study Strengthens Link Between Neonicotinoids and Collapse of Honeybee Colonies, Harvard School of Public Health (May 9, 2014), <https://www.hsph.harvard.edu/news/press-releases/study-strengthens-link-between-neonicotinoids-and-collapse-of-honey-bee-colonies/> [<https://perma.cc/F7RZ-488Y>].

⁴⁴ *Id.*

⁴⁵ HOPWOOD ET AL., *supra* note 7, at viii.

⁴⁶ JOHNSON & CORN., *supra* note 2, at 18.

C. Additional Links Between Neonicotinoids and Declines in Honeybee Health

Studies completed in 2015 refute the idea that honeybees can discern pesticides, showing that honeybees are not able to taste neonicotinoids and are thus not repelled by them.⁴⁷ In fact, when given a choice, the honeybees in the study preferred solutions that contained the imidacloprid and thiamethoxam varieties of neonicotinoids over other solutions, proving that honeybees cannot control their exposure to neonicotinoids.⁴⁸

The chemical composition of neonicotinoids can provide an alternative explanation for why honeybees may be drawn to them. Neonicotinoids work by disrupting certain protein receptors in insects' central nervous systems.⁴⁹ Acetylcholine (ACh) acts as the "major excitatory neurotransmitter" in an insect's central nervous system.⁵⁰ The molecular structures of neonicotinoids closely resemble those in nicotine and initiate physiological responses in nicotinic acetylcholine receptors (nAChRs), a subset of insect ACh receptors.⁵¹ Neonicotinoids are agonists of nAChRs, with the imidacloprid and clothianidin varieties eliciting the strongest responses.⁵² When honeybees ingest neonicotinoids, their ACh neurotransmitters are activated, much like how human neurotransmitters are activated when nicotine enters the human body.⁵³ The metabolic and endocrine

⁴⁷ Sébastien C. Kessler et al., *Bees Prefer Foods Containing Neonicotinoid Pesticides*, 521 NATURE 74, 74 (2015), <https://www-nature-com.libproxy.uoregon.edu/articles/nature/14414.pdf> [<https://perma.cc/374T-NCXN>].

⁴⁸ *Id.*

⁴⁹ Walter Beckwith, *Neonicotinoid Pesticides Impair Bees' Social Behavior*, AM. ASS'N FOR THE ADVANCEMENT OF SCI. (Nov. 9, 2018), <https://www.aaas.org/news/neonicotinoid-pesticides-impair-bees-social-behavior> [<https://perma.cc/G545-R82R>].

⁵⁰ Bernd Grünewald & Paul Siefert, *Acetylcholine and Its Receptors in Honeybees: Involvement in Development and Impairments by Neonicotinoids*, INSECTS, Nov. 2019, at 3, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6955729/pdf/insects-10-00420.pdf> [<https://perma.cc/83H2-5BZL>].

⁵¹ Junko Kimura-Kuroda et al., *Nicotine-Like Effects of the Neonicotinoid Insecticides Acetamiprid and Imidacloprid on Cerebellar Neurons from Neonatal Rats*, 7 (2) PLOS ONE 1 (2012), <https://journals.plos.org/plosone/article/file?id=10.1371/journal.pone.0032432&type=printable> [<https://perma.cc/HL6G-QF68>].

⁵² *Id.* at 3.

⁵³ See Christopher Moffat et al., *Neonicotinoids Target Distinct Nicotinic Acetylcholine Receptors and Neurons, Leading to Differential Risks to Bumblebees*, 6 NATURE 1 (2016), <https://www.nature.com/articles/srep24764.pdf> [<https://perma.cc/286Q-U4QE>].

functions of ACh in honeybees are disrupted by neonicotinoids, which contributes to declines in honeybee colony health.⁵⁴

Researchers have found through recent studies that the long-term application of neonicotinoids has the potential to influence honeybee population growth over multiple generations, showing that bees exposed to neonicotinoids over a two-year period experienced much lower population growth rates compared to bees not exposed to neonicotinoids.⁵⁵ In a study where honeybees were given food contaminated with imidacloprid, reductions in the number of larvae were reported, putting the colony at risk of population imbalance.⁵⁶

Based on past and current research, applying neonicotinoids to crops that require pollination clearly puts honeybees at risk. Neonicotinoids have the power to slowly break down food webs and natural resources, posing a real threat beyond incapacitating invertebrates. The use of neonicotinoids puts honeybees everywhere at risk, which could result in dire consequences for agricultural production by way of disrupting pollination.

II

REFUTING THE ARGUMENTS IN FAVOR OF NEONICOTINOID USE DUE TO THE IMPACT OF NEONICOTINOIDS ON HONEYBEES

A. The Farmer's Dilemma

The minimal benefit and significant environmental detriment that results from using neonicotinoids renders neonicotinoids obsolete. However, many farmers and agricultural advocates still subscribe to the theory that neonicotinoids are the most economically efficient way to protect their crops. Farmers and agricultural companies across the United States remain dedicated to using neonicotinoids to manage pests, causing a reignition in the debate over which is more important: the environment or the economy.

The promising future that neonicotinoids seemed to offer upon their introduction has caused farmers to make some difficult decisions. The current justification for the use of neonicotinoids on crops is primarily based on anecdotal research surrounding neonicotinoids' usefulness for

⁵⁴ *See id.* at 5.

⁵⁵ Amy Quinton, *Pesticides Can Affect Multiple Generations of Bees*, U.C. DAVIS (Nov. 29, 2021), <https://www.ucdavis.edu/climate/news/pesticides-can-affect-multiple-generations-bees> [<https://perma.cc/JSC6-D8SP>].

⁵⁶ Blacquière, *supra* note 1, at 981.

increasing crop yield and reducing the prevalence of pests.⁵⁷ These misconceptions have been exacerbated by the agricultural industry's analysis that relies on non-peer-reviewed research that overestimates the value of neonicotinoids.⁵⁸ The near-ubiquitous use of neonicotinoids today makes it difficult for small farmers to break the cycle of using them, especially when faced with pressure and misinformation from large corporations.⁵⁹ These corporations tout advantages of neonicotinoids when communicating with these farmers, highlighting their ability to treat soil-inhabiting pests that would be otherwise difficult to control and their low toxicity to farmers and farmworkers.⁶⁰ The perceived difficulty in obtaining viable alternatives and concerns about crop yield has caused many farmers to latch onto using neonicotinoids to protect their crops, a decision that has put them in the middle of the discussion about the link between agriculture, pesticides, and honeybee decline.

Seed farmers are among the largest subset of farmers who claim to have experienced difficulty finding alternatives to neonicotinoids.⁶¹ One alternative to using seeds treated with neonicotinoids is increased tillage of land, which seed farmers claim would only add to soil erosion and would require more use of fossil fuel-burning farm equipment.⁶² Neonicotinoid seed treatments are most commonly used on crops of grain, oilseed, and soybeans.⁶³ The United States is the number one producer of soybeans worldwide.⁶⁴ Based on current trends, scientists expect that well over fifty percent of planted soybeans in the United States are treated with neonicotinoids.⁶⁵ Therefore, the consensus among farmers who choose to apply neonicotinoids in some form is

⁵⁷ DOUG GURIAN-SHERMAN, CTR. FOR FOOD SAFETY, ALTERNATIVES TO NEONICOTINOID INSECTICIDE-COATED CORN SEED: AGROECOLOGICAL METHODS ARE BETTER FOR FARMERS AND THE ENVIRONMENT 5 (May 2017), https://www.centerforfood.safety.org/files/alternatives-to-neonics_v9_23186.pdf [<https://perma.cc/JJX4-HX2C>].

⁵⁸ *Id.*

⁵⁹ *Id.* at 7.

⁶⁰ *Id.* at 15.

⁶¹ See Rick Carlin, *New York Farmers Push Back Against Neonicotinoid Seed Ban*, TIMES UNION (May 18, 2021, 3:46 PM), <https://www.timesunion.com/news/article/Farmers-say-seed-ban-would-hit-them-in-16185436.php> [<https://perma.cc/432D-EGDZ>].

⁶² *Id.*

⁶³ Spyridon Mourtzinis et al., *Neonicotinoid Seed Treatments of Soybean Provide Negligible Benefits to US Farmers*, 9 NATURE 1, 1 (2019), <https://www.nature.com/articles/s41598-019-47442-8.pdf> [<https://perma.cc/7M5K-EVR6>].

⁶⁴ *Id.*

⁶⁵ *Id.*

that the unique challenges they face daily can be remedied only by using neonicotinoids and that the economic security neonicotinoids can provide is essential to a farmer's livelihood.⁶⁶

The economic justifications for using neonicotinoids are closely related to the significant economic value of pollinators like honeybees. Commercial honeybee operations are essential to agricultural production in the United States, pollinating \$15 billion worth of food crops each year.⁶⁷ Approximately one hundred flowering food crops grown in the United States are pollinated by honeybees, including nuts, avocados, soybeans, citrus fruit, peaches, and animal-feed crops such as clover grown for feeding dairy cows.⁶⁸ To combat the environmental concerns that have emerged over neonicotinoid use, entities that rely on the economic benefits of honeybees, such as the California Almond Board, encourage their members to plant pollinator habitats near or within their orchards.⁶⁹ These pollinator habitats provide honeybees with additional food sources aside from almond blooms and provide the added benefit of improving carbon sequestration, enhancing soil health, and boosting water infiltration.⁷⁰

Beyond increases in direct costs, farmers and agricultural advocates have begun to determine that neglecting to use neonicotinoids could cause a decline in their yields, affecting both revenue and "how many people they could feed both domestically and internationally."⁷¹ Numerous growers across different crops and regions noted an increase in yield resulting from treatment with neonicotinoids, expressing that this yield bump was a combination of both the insecticide protecting the plant from insect pressure and what they described as a "plant growth regulator effect."⁷² Farmers also found that applying neonicotinoid treatments to young plants allowed the plants to emerge

⁶⁶ George Smith, 'Disappointing' and 'Unjustified': Farmers React to Neonicotinoid Ban, NEW FOOD MAG. (Apr. 30, 2018), <https://www.newfoodmagazine.com/news/66517/neonicotinoids-european-commission/> [<https://perma.cc/FLR8-SH2M>].

⁶⁷ Josh Woods, *US Beekeepers Continue to Report High Colony Loss Rates, No Clear Progression Toward Improvement*, AUBURN UNIV. (June 25, 2021), https://ocm.auburn.edu/newsroom/news_articles/2021/06/241121-honey-bee-annual-loss-survey-results.php [<https://perma.cc/ZF6F-2CRC>].

⁶⁸ *Silence of the Bees: Impact of CCD on U.S. Agriculture*, PBS (July 20, 2009), <https://www.pbs.org/wnet/nature/silence-of-the-bees-impact-of-ccd-on-us-agriculture/37/> [<https://perma.cc/T72D-6D5E>].

⁶⁹ See *Nature's Perfect Duo*, CAL. ALMONDS, <https://www.almonds.com/why-almonds/growing-good/honey-bees> [<https://perma.cc/5JL3-N4S9>] (last visited Mar. 10, 2022).

⁷⁰ *Id.*

⁷¹ See SHAW & GENSKOW, *supra* note 15, at 7.

⁷² *Id.*

healthier and stronger due to reduced pest pressure, which in turn led to further benefits, such as better resistance to extreme weather.⁷³

Finally, farmers are wary of alternative options to neonicotinoids. Alternative insecticides or pest control strategies are readily available, existing for many relevant target pests.⁷⁴ Reluctance to make this switch largely stems from the fact that shifting away from the use of neonicotinoids normally results in direct or indirect costs to users.⁷⁵ When farmers choose to use a neonicotinoid insecticide, they typically do so because those products are considered the best option when considering factors such as “price, efficacy, safety, [and] insecticide rotation pattern”⁷⁶

Neonicotinoids are particularly valued by farmers who use them in IPM programs.⁷⁷ IPM programs use neonicotinoids to selectively control insect pests, allowing farmers to keep beneficial insects alive and potential insect pests in check.⁷⁸ Neglecting to use neonicotinoids implies greater reliance on two chemical classes: pyrethroids and organophosphates.⁷⁹ Reliance on these classes increases the probability that pests will develop resistance to pesticides more quickly, since the level of pest control that alternative pesticides provide differs significantly from the level of pest control neonicotinoids provide.⁸⁰ Thus, neonicotinoids’ value lies in the expected increase in benefits from using the neonicotinoid product instead of the stagnant results that occur when using the best available non-neonicotinoid pest control products.⁸¹

B. The Disadvantages of Neonicotinoids Outweigh Their Economic Benefits

The benefits of neonicotinoid use are offset by greater risks. One such risk is exposure to neonicotinoids through dust released during seed coating at planting and the unavoidable need to apply more

⁷³ See *id.* at 7–8.

⁷⁴ See GROUT ET AL., *supra* note 9, at 99.

⁷⁵ *Id.* at 21.

⁷⁶ *Id.*

⁷⁷ See *Integrated Pest Management*, *supra* note 12.

⁷⁸ *Id.*

⁷⁹ AGINFOMATICS, THE VALUE OF NEONICOTINOIDS IN NORTH AMERICAN AGRICULTURE: EXECUTIVE SUMMARY 8 (2015), https://aginfomatics.com/uploads/3/4/2/2/34223974/executive_summary_neonicotinoids.pdf [<https://perma.cc/ZH6J-KCLC>].

⁸⁰ *Id.* at 10.

⁸¹ GROUT ET AL., *supra* note 9, at 21.

insecticide per unit.⁸² Insecticides can be transported by dust that drifts from treated seeds and aerosols at their application site to a site where pollinators and people are present, such as wildflowers and soils on nearby properties.⁸³ When neonicotinoid seed treatments are applied to seeds, insects are more likely to ingest a lethal dose of the pesticide due to neonicotinoids' ability to move into the plant through its roots and vascular system.⁸⁴ Although studies are still in the preliminary stages, researchers have found that chronic and acute exposures to neonicotinoids can cause a variety of neurological and developmental disorders in humans and other mammals.⁸⁵ These potential risks to human health, on top of the detriment to honeybee health, illustrate the disadvantages of neonicotinoid use.

Solutions like those proposed by the California Almond Board, while not infallible, do suggest that farmers and agricultural entities can strike a balance between maintaining economic gain and environmental protection if they so choose.

C. The Power Imbalance Between Small-Scale Farms and Big Corporations

Rapid advancements in the American agricultural industry over the last forty years have highly concentrated the United States' food supply chain and caused a handful of giant multinational corporations to control the market.⁸⁶ This concentration has led to a crisis among farmers and others in rural communities who survive on agriculturally driven economies.⁸⁷ The monopolies created by large agribusinesses have led to a decrease in food quality and negative effects on agriculture's environmental footprint, making concentration in agriculture a concern for urban and rural communities alike.⁸⁸

Large-scale farmers are quick to position themselves as business owners making choices that benefit their economic interests and maintain that the current realities of the economy leave them with no

⁸² *Id.* at 196.

⁸³ *Id.* at 195.

⁸⁴ HOPWOOD ET AL., *supra* note 7, at 6.

⁸⁵ Andrea M. Cimino et al., *Effects of Neonicotinoid Pesticide Exposure on Human Health: A Systematic Review*, 125 ENV'T HEALTH PERSPS. 155, 156 (2017).

⁸⁶ CLAIRE KELLOWAY & SARAH MILLER, FOOD AND POWER: ADDRESSING MONOPOLIZATION IN AMERICA'S FOOD SYSTEM 3 (2021), https://static1.squarespace.com/static/5e449c8c3ef68d752f3e70dc/t/614a2ebeb7d510debfd53f3/1632251583273/200921_MonopolyFoodReport_endnote_v3.pdf [<https://perma.cc/6WQK-MCEA>].

⁸⁷ *Id.* at 2.

⁸⁸ *Id.* at 2–3.

choice but to use neonicotinoids. Small-scale farmers, however, tell a different story. Today, virtually all American seed farmers must purchase seeds and pesticides from a small subset of giant agribusinesses.⁸⁹ Farmers are forced to choose between conglomerates like Bayer, which absorbed notorious agrichemical company Monsanto in 2018, or Sygenta, the world’s largest manufacturer of agrichemicals.⁹⁰ The rapid consolidation of companies like Bayer and Sygenta has caused farm inputs to skyrocket in price, resulting in these inputs exceeding the value of profits farmers receive for selling their crops.⁹¹ Corporations use seed and chemical “product pairings” to gain and retain control over their producers.⁹² These “product pairings” all but force farmers into a sort of “pesticide treadmill” that causes a damaging dependency on seed and chemical inputs to produce healthy crops.⁹³

Not all farmers are in favor of a world where conglomerates like Bayer and Sygenta dominate the agricultural industry. One farmer in New York articulated this view by stating that a “simplistic, extractive approach” like the one currently used in the agribusiness industry should not suffice, and that farming based on a “holistic, sustainable approach” would be the best way forward for farmers and the environment.⁹⁴ This point of view, while not representative of every farmer’s opinion, signals that many small farmers are interested in pursuing alternative practices that would better benefit their farms and the environment.

The overwhelming amount of influence that a select number of wealthy and powerful agribusinesses exert over American farmers presents great cause for concern. The lack of choice in the marketplace, especially when it comes to pesticides, puts small family farms at a significant disadvantage. To have any hope of competing in the marketplace, small farmers often feel pressured to use neonicotinoids to keep up with large farms and the gigantic corporations that support them, reemphasizing the need for practical economic alternatives.

⁸⁹ *Id.* at 6.

⁹⁰ *Id.* at 7.

⁹¹ *Id.* at 6.

⁹² *Id.*

⁹³ *Id.*

⁹⁴ Chris Torres, 2 *Farmers Offer Differing Views on Neonics*, AMERICAN AGRICULTURIST (July 9, 2021), <https://www.farmprogress.com/commentary/2-farmers-offer-differing-views-neonics> [<https://perma.cc/7XMZ-TGNC>] (quoting Yusuf Harper, farmer and president of Pure Grown in Chenango County, New York).

D. Viable Economic Alternatives to Neonicotinoids

Among the concerns raised by the possibility of reducing or eliminating neonicotinoid application is the potential for more harmful insecticides to take their place.⁹⁵ Despite these concerns, early research suggests that viable alternatives to neonicotinoids do exist and that application of these alternatives can lessen the negative consequences of neonicotinoids on the environment and the farmers who choose to apply them. In a small study of twenty-eight specific cases, researchers were able to identify both chemical and nonchemical substitutable alternatives for most neonicotinoid uses.⁹⁶ Another study showed that certain systemic insecticides, like azadirachtin, an insecticide that does not persist in the environment and does not present significant risk to most nontarget vertebrates, can act as promising alternatives to neonicotinoids.⁹⁷

Although the research and development surrounding alternatives to neonicotinoids is still ongoing, the fact that alternatives are available and companies are working to produce them is a sign that neonicotinoid use could soon become obsolete.

III

THE LACK OF LEGAL VIABILITY FOR NEONICOTINOID USE

A. Further Evidence of the Negative Impact of Neonicotinoids: The Federal Insecticide, Fungicide, and Rodenticide Act

The introduction of various state and federal legislation related to the regulation of neonicotinoids demonstrates that neonicotinoid use is an issue that has garnered the concern of legislatures across the United States. The environmental issues posed by neonicotinoids have been a hot topic around the world for over ten years. Legislation aiming to restrain or prohibit neonicotinoid use has only gained traction over the last half decade, but legislation broadly related to pesticides has existed for much longer. Perhaps the most well-known piece of federal legislation related to pesticides is the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), first enacted in 1947.⁹⁸ FIFRA prohibits

⁹⁵ GURIAN-SHERMAN, *supra* note 57, at 52.

⁹⁶ Hervé Jactel et al., *Alternatives to Neonicotinoids*, 129 ENV'T INT'L 423, 425 (2019).

⁹⁷ Lorenzo Furlan & David Kreutzweiser, *Alternatives to Neonicotinoid Insecticides for Pest Control: Case Studies in Agriculture and Forestry*, 22 ENV'T SCI. POLLUTION RSCH. INT'L 135, 142 (2015).

⁹⁸ *Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Federal Facilities*, ENV'T PROT. AGENCY, <https://www.epa.gov/enforcement/federal-insecticide-fungicide-and>

the sale of pesticides that lack approval and registration by the EPA.⁹⁹ All new pesticides bought and sold in the United States go through the EPA's approval process, which stipulates that applicants show that the pesticide "will not generally cause unreasonable adverse effects on the environment," among other requirements.¹⁰⁰ The term "unreasonable adverse effects on the environment" is defined under FIFRA as "(1) 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, or (2) a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the standard under section 408 of the Federal Food, Drug, and Cosmetic Act."¹⁰¹

The United States Department of Agriculture (USDA) initially administered FIFRA, since FIFRA was primarily intended to require pesticides to be labeled accurately and to give farmers the ability to make their own decisions about pesticide application.¹⁰² Concerns about pesticides' toxic effects on applicators, nontarget organisms, the environment, and food have led to major changes to FIFRA from its original form.¹⁰³ In 2003, the Pesticide Registration Improvement Act amended FIFRA to strengthen the enforcement provision, broaden the act's legal power to protect the environment, and regulate the use of pesticides, among other reforms.¹⁰⁴ These reforms have helped limit the use of neonicotinoids, leading to better outcomes for honeybee health.

The broad range of responsibilities the EPA has in managing pesticides under FIFRA should have, in theory, meant that pesticides with harmful ingredients like neonicotinoids never gained approval. However, the EPA has approved the use of neonicotinoids time and time again, even as evidence begins to pile up suggesting their negative environmental impact. In 2019, the EPA granted emergency exceptions under FIFRA for the use of clothianidin, thiamethoxam, and

-rodenticide-act-fifra-and-federal-facilities [https://perma.cc/9DTS-N4Y4] (last updated Apr. 8, 2023) [hereinafter *FIFRA and Federal Facilities*].

⁹⁹ Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. § 136a(a).

¹⁰⁰ *Summary of the Federal Insecticide, Fungicide, and Rodenticide Act*, ENV'T PROT. AGENCY, <https://www.epa.gov/laws-regulations/summary-federal-insecticide-fungicide-and-rodenticide-act> [https://perma.cc/9DYB-HLDP] (last updated Apr. 8, 2023) [hereinafter *FIFRA Summary*].

¹⁰¹ *Id.*

¹⁰² *FIFRA and Federal Facilities*, *supra* note 98.

¹⁰³ *Id.*

¹⁰⁴ *Id.*

dinotefuran,¹⁰⁵ some of the most potent neonicotinoids, but did not define the need for the emergency declaration. The EPA approved this emergency use on almost 400,000 acres of flowering fruit trees and rice crops,¹⁰⁶ all of which require honeybee pollination. Of the nine neonicotinoid approvals granted in 2019, five were handed out for nine consecutive years prior for the same emergency.¹⁰⁷ By arbitrarily approving the use of neonicotinoids in the name of an emergency, the EPA failed to recognize and protect against the harmful effects of neonicotinoids.

By 2020, the EPA had changed its tune, further providing evidence of the negative impacts of neonicotinoid use. Proposed interim decisions for acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam were released and included requiring new management measures.¹⁰⁸ These measures aimed to reduce the amount of pesticides used on crops, restrict permissions to apply pesticides to crops, and update pesticide labels.¹⁰⁹ These interim decisions were made in an attempt to protect pollinators and regulate neonicotinoid use more closely.¹¹⁰ The EPA built upon this progress in 2021, issuing draft biological evaluations for clothianidin, imidacloprid, and thiamethoxam, determining that each of these chemicals were “likely to adversely affect certain listed species or their designated critical habitats.”¹¹¹ Additionally, the use of chlorpyrifos, a pesticide that has come under scrutiny similar to that of neonicotinoids, was restricted for agricultural use by the EPA in August 2021.¹¹² The steps taken by the EPA to restrict the use of harmful pesticides are positive but signal that progress through federal agencies is slow and arduous. Fluctuations in the priorities of presidential administrations and a severely polarized Congress can lead to even further delays, making reliance on the EPA alone an imperfect solution. Proposed legislation at the state and federal

¹⁰⁵ *Trump EPA*, *supra* note 18.

¹⁰⁶ *Id.*

¹⁰⁷ *Id.*

¹⁰⁸ *EPA Actions to Protect Pollinators*, ENV'T PROT. AGENCY, <https://www.epa.gov/pollinator-protection/epa-actions-protect-pollinators> [<https://perma.cc/GU3G-Q53R>] (last updated Apr. 8, 2023).

¹⁰⁹ *Id.*

¹¹⁰ *Id.*

¹¹¹ *EPA Releases Draft Biological Evaluations of Three Neonicotinoids for Public Comment*, ENV'T PROT. AGENCY (Aug. 26, 2021), <https://www.epa.gov/pesticides/epa-releases-draft-biological-evaluations-three-neonicotinoids-public-comment> [<https://perma.cc/68C2-SJRH>].

¹¹² Frabotta, *supra* note 19.

levels aiming to restrict neonicotinoid application can help ease the burden on the EPA and ensure neonicotinoid use is properly regulated.

***B. Where We Are Now:
Federal and State Neonicotinoid Legislation***

Efforts to enact legislation to restrict or prohibit the use of neonicotinoids have been stonewalled in Congress over the past few years. In 2019, Oregon Congressman Earl Blumenauer introduced the Saving America’s Pollinators Act, which aimed to establish a federal Pollinator Protection Board and would have canceled the registrations of any neonicotinoid pesticides.¹¹³ The Pollinator Protection Board would have been housed under the EPA and would have assisted in the development of “an independent review process for pesticides that pose a threat to pollinators and pollinator habitat.”¹¹⁴ The bill died in committee but was reintroduced by Blumenauer and Congressman Jim McGovern of Massachusetts in 2021.¹¹⁵ The 2021 version of the Act closely resembles the 2019 version and expands upon the duties of the proposed Pollinator Protection Board.¹¹⁶ The bill, despite enjoying support from over seventy cosponsors, is currently stalled in committee.¹¹⁷

Senator Cory Booker of New Jersey recently introduced a bill in the Senate—the Protect America’s Children from Toxic Pesticides Act—that aims to completely ban the use of neonicotinoid insecticides.¹¹⁸ Booker’s bill points out the EPA’s slow review process of harmful pesticides under FIFRA and would require the EPA to take continued, quick action to review and eliminate said pesticides.¹¹⁹ The bill would also limit the EPA’s power to issue emergency exceptions.¹²⁰ The bill has failed to gain much traction in the Senate, and currently sits in the Senate Committee on Agriculture, Nutrition, and Forestry.¹²¹

¹¹³ Saving America’s Pollinators Act, H.R. 1337, 116th Cong. (2019).

¹¹⁴ *Id.* § 3(a).

¹¹⁵ *Legislation to Save the Bees*, *supra* note 23.

¹¹⁶ Saving America’s Pollinators Act of 2021, H.R. 4079, 117th Cong. (2021).

¹¹⁷ *Id.* (The legislation has not moved out of the House Agriculture Subcommittee on Biotechnology, Horticulture, and Research.).

¹¹⁸ S. 3283, 117th Cong. (2021).

¹¹⁹ *Id.*

¹²⁰ *Id.* § 7.

¹²¹ S. 3283. (The legislation has not moved out of the Senate Committee on Agriculture, Nutrition, and Forestry.).

Bills introduced in state legislatures across the United States have opted for a slightly less ambitious approach. Oregon was one of the first states to take action to restrict neonicotinoid use by passing the Save Oregon Pollinators Act in 2014.¹²² The Save Oregon Pollinators Act requires the Oregon Department of Agriculture to work with Oregon State University to develop educational materials regarding best practices for avoiding the adverse effects of pesticides on populations of bees and other pollinating insects, and it requires that these materials be made part of trainings for pesticide applicator licensing examinations.¹²³ In 2016, Maryland's General Assembly passed similar legislation called The Pollinator Protection Act.¹²⁴ The Pollinator Protection Act restricts consumer use of neonicotinoids by requiring retailers that possess and sell neonicotinoids for outdoor use to obtain a Restricted Use Pesticide (RUP) permit.¹²⁵

These statewide victories, while small, indicate that making incremental legislative changes to neonicotinoid regulations may be the most effective method for bringing about change. The proposals at the federal level to completely end the use of neonicotinoids are bold, but the influence of large corporations in the agricultural space, coupled with a politically polarized Congress, makes accomplishing these lofty environmental goals difficult. Moving forward, it is likely that environmental advocates will find the most success with gradual implementation of restrictions to neonicotinoid application.

C. Legal Challenges to the Use of Neonicotinoids

Numerous lawsuits have been filed over the past decade by environmental advocates seeking legal recourse for the damage that neonicotinoids inflict on pollinators. In 2013, the Center for Food Safety led a large group of plaintiffs in filing a civil suit against the

¹²² *Legislative/Policy Victories in 2014*, BEYOND TOXICS, <https://www.beyondtoxics.org/work-2/accomplishments-of-the-save-oregons-bees-campaign/> [<https://perma.cc/HY3X-BMXX>] (last visited Nov. 18, 2022); see H.B. 4139, 77th Legis. Assemb., Reg. Sess. (Or. 2014).

¹²³ H.B. 4139.

¹²⁴ *Maryland Becomes the First State in the Country to Restrict Bee-Killing Pesticides*, MD. PESTICIDE NETWORK, <https://mdpestnet.org/take-action/smart-on-pesticides-maryland/pollinator-protection-act-passes/> [<https://perma.cc/PUC8-98KN>] (last visited Apr. 8, 2023).

¹²⁵ *Information Sheet: Pollinator Protection Act of 2016*, MD. DEP'T. OF AGRIC. PESTICIDE REGUL. SECTION, <https://mda.maryland.gov/plants-pests/Documents/PollinatorProtectionActFactSheet.pdf> [<https://perma.cc/EFZ5-BSJQ>] (last visited Apr. 8, 2023).

EPA.¹²⁶ The plaintiffs' complaint alleged that the EPA had failed to protect pollinators from dangerous pesticides and failed to suspend registering insecticides that have been identified as being highly toxic to honeybees, such as neonicotinoids.¹²⁷ The lawsuit also challenged "conditional registrations" for toxic pesticides, which allowed the EPA to expedite commercialization of pesticides by bypassing premarket review.¹²⁸ The case settled in 2019, with pesticide makers and environmental advocates agreeing to voluntarily cancel registrations for pesticides that contain clothianidin and thiamethoxam neonicotinoids.¹²⁹ As part of the settlement, the parties in the lawsuit agreed that the EPA will complete biological evaluations on the impacts of neonicotinoids on endangered species in 2022.¹³⁰ The Center for Food Safety filed another lawsuit against the EPA in late 2021, alleging that the agency failed to regulate seeds coated with neonicotinoids.¹³¹ The lawsuit stems from a rulemaking petition the Center filed in 2017, which demanded that the EPA close a regulatory loophole allowing seeds coated with systemic pesticides to evade the registration and labeling requirements of FIFRA.¹³² If the court grants the plaintiffs' request, the EPA will be required to formally respond to the Center's 2017 petition.¹³³ The EPA can either deny the petition or begin drafting the rule, which could lead to pesticide-coated seeds no longer qualifying for the treated article exemption.¹³⁴

The trends in legislative and legal action over the past decade suggest that state legislatures and district courts will likely be the

¹²⁶ Paul Towers et al., *Beekeepers and Public Interest Groups Sue EPA Over Bee-Toxic Pesticides*, PESTICIDE ACTION NETWORK (Mar. 21, 2013), <https://www.panna.org/press-release/beekeepers-and-public-interest-groups-sue-epa-over-bee-toxic-pesticides> [<https://perma.cc/454N-4J5N>].

¹²⁷ *Id.*

¹²⁸ *Id.*

¹²⁹ Steve Davies, *Neonicotinoid Makers, Enviro Both Applaud Settlement*, AGRIPULSE (May 29, 2019, 6:35 AM), <https://www.agri-pulse.com/articles/12245-neonicotinoid-makers-enviros-both-applaud-settlement> [<https://perma.cc/D8F8-E9PA>].

¹³⁰ *Id.*

¹³¹ *EPA Sued Over Failure to Close Pesticide-Coated Seed Loophole Killing Bees and Endangered Species*, CTR. FOR FOOD SAFETY (Dec. 15, 2021), <https://www.centerforfood-safety.org/press-releases/6531/epa-sued-over-failure-to-close-pesticide-coated-seed-loophole-killing-bees-and-endangered-species> [<https://perma.cc/3BMC-NQ6Z>].

¹³² *Id.*

¹³³ Brigit Rollins, *Environmental Groups Challenge EPA Over Treated Seeds*, NAT'L AGRIC. L. CTR. (Mar. 3, 2022), <https://nationalaglawcenter.org/environmental-groups-challenge-epa-over-treated-seeds/> [<https://perma.cc/Z7RQ-UTG2>].

¹³⁴ *Id.*

primary sites of legislative and legal battles about the use of neonicotinoids in the future. Environmental advocates will likely continue to challenge the EPA and its actions under FIFRA, while agricultural advocates will likely continue to push back against proposed restrictions to pesticide application. The controversial prevalence of neonicotinoid application in American agriculture means that these legal and legislative conflicts will undoubtedly continue to exist moving forward.

CONCLUSION

The environmental harm caused by using neonicotinoids in agriculture far outweighs their potential economic benefits. Research linking neonicotinoid application to harm caused to honeybees and the environment clearly indicates that neonicotinoid use must be restricted. The price of pesticides is simply too high to justify putting honeybees and our earth in peril. Moving forward, farmers, scientists, and advocates must collaborate and compromise to create a balance between economic stability and environmental conservation.